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APPLICATION OF GENERALIZED  
NEWTONIAN THEORY TO  
THREE-DIMENSIONAL SHARP-NOSE  
SHOCK-DETACHED BODIES AT MACH 6  
FOR ANGLES OF ATTACK UP TO  $25^\circ$

by George C. Ashby, Jr., and Theodore J. Goldberg

Langley Research Center

Langley Station, Hampton, Va.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION • WASHINGTON, D. C. • JANUARY 1965

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## ERRATA

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### APPLICATION OF GENERALIZED NEWTONIAN THEORY TO THREE-DIMENSIONAL SHARP-NOSE SHOCK-DETACHED BODIES AT MACH 6 FOR ANGLES OF ATTACK UP TO 25°

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Pages 12 to 14, table I: The points where the afterbodies begin are not identified; they are as follows:

Model	(a) Parabolic-arc models		(b) Circular-arc models		(c) Conical models	
	x	s/r <sub>b</sub>	x	s/r <sub>b</sub>	x	s/r <sub>b</sub>
56°	5.67	3.122	3.761	2.110	1.349	1.206
66°	6.26	3.431	3.079	1.941	.890	1.095
78°	10.27	5.415	2.470	1.685	.425	1.020
90°	7.46	4.075	2.000	1.560	0	1.000

Page 14, table I(c): The orifices located at  $r = 2.000$  inches are on the afterbodies; therefore, they have surface slopes of 0° instead of the values listed.

APPLICATION OF GENERALIZED NEWTONIAN THEORY  
TO THREE-DIMENSIONAL SHARP-NOSE SHOCK-DETACHED BODIES  
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SUMMARY

Pressure distributions were obtained for three-dimensional sharp-nose parabolic-arc, circular-arc, and conical bodies having an apex half-angle greater than that for shock detachment (aerodynamically blunt bodies) at Mach number of 6 for angles of attack up to 25°. The maximum pressure coefficient was found to increase continuously from the shock-attachment value to the stagnation value behind a normal shock between apex deflection angles of 56° and 61°, 65°, or 69° depending on the body contour. The data for contoured bodies are correlated very well by the generalized form of Newtonian theory. In addition, at all angles of attack for all aerodynamically blunt bodies having curved surfaces, the agreement between the generalized form of the Newtonian theory and the measured values of pressure coefficient was reasonably good for surface-deflection angles above 30°. This theory can be used to predict pressures on most three-dimensional bodies by the methods shown herein. With few exceptions, at a given surface deflection angle the pressure distributions rearward of the maximum pressure on the 180° and 0° meridians of aerodynamically blunt cones are essentially coincident with those of cones having higher and lower half-angles, respectively. In addition, the pressure distributions of these cones are in good agreement aft of the maximum pressure point with those of a flat plate and aerodynamically blunt wedges at corresponding deflection angles of 66° and above.

INTRODUCTION

The need for a simple and reasonably accurate method of rapidly predicting the pressure distributions on bodies in hypersonic flow has prompted numerous investigations of the applicability of the Newtonian theory for such purposes. Various modifications of the basic Newtonian equation

$$C_p = K \sin^2 \delta$$

where  $C_p$  is the pressure coefficient and  $\delta$  is the flow deflection angle have been found to give reasonably good predictions of the pressure distributions on different bodies if the proper value of the constant  $K$  is chosen. For example, it is shown in reference 1 that with  $K = (\gamma + 1)$  the theory is applicable only

to bodies having small leading-edge angles; and in reference 2, with  $K = C_{p,\text{stag}}$  the theory is limited to bodies having  $90^\circ$  leading-edge or apex slopes. A more recent consideration of the Newtonian theory is presented in reference 3, which suggests that in the general case  $K$  has the form  $C_{p,\text{max}}/\sin^2\delta_{\text{max}}$ . This relationship resulted in the generalized form of Newtonian theory

$$\frac{C_p}{C_{p,\text{max}}} = \frac{\sin^2\delta}{\sin^2\delta_{\text{max}}}$$

which was shown to correlate and predict the surface pressure distribution reasonably well for pointed-nose bodies having leading-edge or apex half-angles less than that for shock detachment as well as for bodies having a  $90^\circ$  leading-edge or apex slope. (Unpublished work also shows that this generalized form of Newtonian theory can be derived by resorting to the tangent-cone approximations.) The validity of this form was further substantiated in reference 4 where it was shown to apply to two-dimensional bodies with leading-edge half-angles greater than that for shock detachment (aerodynamically blunt bodies) provided they have curved surfaces.

Because of the complete lack of experimental pressure distributions for three-dimensional aerodynamically blunt bodies at hypersonic speed, it has not been possible to determine the applicability of the generalized form of Newtonian theory to these bodies. Such shapes may be of current interest for configurations entering into the earth's atmosphere at speeds in excess of earth parabolic speed for which the radiative heating is much greater than the convective heating (ref. 5). Since the radiative heating at these speeds varies as about the 15th power of the sine of the shock angle, even small decreases in shock angles which may be obtained from these bodies can appreciably decrease the radiative heating. A part of the atmospheric descent of such bodies will be flown at hypersonic speeds and the analysis of the aerodynamic forces and moments, as well as of the convective heat transfer, will require estimates of the pressure distributions. In addition, as shown in reference 6, these data, along with the two-dimensional data of reference 4, may be applicable to the leading edge and nose of delta wings at hypersonic speeds.

The purpose of this paper is to provide experimental pressure distributions on a series of three-dimensional parabolic-arc, circular-arc, and conical bodies having apex half-angles from  $56^\circ$  to  $90^\circ$  and to determine the applicability of the generalized form of Newtonian theory of reference 3 to this class of bodies. The pressure distributions were measured in the Langley 20-inch Mach 6 tunnel at angles of attack up to  $25^\circ$ .

#### SYMBOLS

$C_p$  pressure coefficient,  $\frac{p - p_\infty}{\frac{1}{2}\rho p_\infty M_\infty^2}$

$K$  constant

M	free-stream Mach number
p	pressure
r <sub>b</sub>	base radius
s	distance along body surface from nose
s <sub>c</sub>	total length of cone surface
x,r	body coordinates
$\alpha$	angle of attack
$\gamma$	ratio of specific heats (1.4 for air)
$\delta$	local inclination of body surface referenced to wind axis
$\theta$	local inclination of body surface referenced to body axis (see sketch in table I)
$\phi$	angular coordinate of meridional plane

Subscripts:

a	apex
geom	geometric
l	local
max	maximum
meas	measured
stag	stagnation behind normal shock
t	total or stagnation conditions
$\infty$	free-stream conditions

#### APPARATUS AND METHODS

##### Wind Tunnel and Models

This investigation was conducted in the Langley 20-inch Mach 6 tunnel. This tunnel, which has been described in reference 7, is a blowdown-to-atmosphere type capable of operation at stagnation pressures of 7 to 38 atmospheres and a maximum

stagnation temperature of  $600^{\circ}$  F. The Mach number is achieved with fixed two-dimensional nozzle blocks forming a test section 20.5 inches high and 20 inches wide.

The three groups of 4 three-dimensional models used in this investigation (fig. 1) consisted of parabolic-arc, circular-arc, and conical bodies which were analytically derived so that the apex half-angles of each group were  $56^{\circ}$ ,  $66^{\circ}$ ,  $78^{\circ}$ , and  $90^{\circ}$ . These models are identified herein by their apex half-angles and contours. These contours were selected because the cone and parabolic arc represent the minimum and maximum surface curvature, respectively, whereas the circular arc represents an intermediate curvature. All models were 4.0 inches in diameter at the base with a constant afterbody length of 2.56 inches. These bodies incorporated a "quick-disconnect" type of connection to facilitate model changes. A photograph of one of the models attached to the support connection is shown in figure 2. The majority of orifices were located along the  $0^{\circ}$  and  $180^{\circ}$  meridians with additional orifices located at the  $45^{\circ}$ ,  $90^{\circ}$ ,  $135^{\circ}$ , and  $270^{\circ}$  meridians. The model dimensions along with the orifice locations  $x, r$ , the local inclinations at the orifices, and the surface distances nondimensionalized by the base radius are presented in table I. The inside orifice diameter for all models was 0.21 inch near the nose and 0.063 inch at all other orifice locations.

The models were supported in the tunnel by the gooseneck support system shown in figure 3, which moved the model  $25^{\circ}$  in angle of attack in the horizontal plane. A mechanically operated counter geared to the vertical shaft of the support system was used to measure the angle of attack. Deflections due to air loads were assumed to be negligible because of the stiffness of the sting support.

#### Tests

All models were tested in  $5^{\circ}$  increments over an angle-of-attack range of  $0^{\circ}$  to  $25^{\circ}$ . In addition, the  $56^{\circ}$  models were tested in  $1^{\circ}$  increments at angles of attack from  $0^{\circ}$  to  $14^{\circ}$ .

All tests reported herein were conducted at a stagnation pressure of 400 lb/sq in. abs and a stagnation temperature of  $400^{\circ}$  F, which yields a Reynolds number per foot of  $7.6 \times 10^6$ .

Pressure data were recorded by photographing a multiple-tube mercury manometer for pressures greater than 1 lb/sq in. abs. For pressures of 1 lb/sq in. abs or less, a butyl phthalate manometer was used to obtain greater accuracy because of the low specific gravity of this fluid. Tunnel stagnation pressure was measured with a 0 to 600 lb/sq in. Bourdon gage. All pressures were photographically recorded simultaneously for a given run.

#### Data Reduction and Accuracy

The data were reduced on the basis of the known Mach number distribution as explained in reference 4. When the maximum measured pressure ratio (ratio of local pressure on model to tunnel stagnation pressure) was not equal to the total pressure ratio across a normal shock for a Mach number within the known tunnel

Mach number variation ( $5.99 \pm 0.005$ ), the Mach number distribution, which matched a previous tunnel calibration, was used.

The location of the maximum pressure point for each model at each angle of attack was determined from faired curves of  $p_l/p_t$  against  $\theta$  on the  $0^\circ$  and  $180^\circ$  meridians. If no peak occurred beyond the first orifice, the values of  $p_l/p_t$  and  $\theta$  at the first orifice were used to compute  $C_{p,\max}$  and  $\delta_{\max}$ . If a peak occurred downstream of the first orifice, the faired values were used to compute  $C_{p,\max}$  and  $\delta_{\max}$ .

The maximum error of the measured pressures is believed to be less than 1 percent of the maximum measured value on the body. Model alignment and angles of attack are believed to be accurate to better than  $\pm 1/2^\circ$ . The accuracy of the  $x,r$  coordinates of the model orifices is  $\pm 0.001$  inch. The measured coordinates were used to compute the slopes for all orifices.

## RESULTS AND DISCUSSION

### Experimental Results

Basic data.- The pressure distributions for the three-dimensional aerodynamically blunt bodies are presented in figures 4, 5, and 6 for angles of attack up to  $25^\circ$ . In addition, schlieren photographs of all the bodies at  $0^\circ$  angle of attack are presented in figure 7 to show the variation of the shock shape with changes in apex half-angle and body contour.

Maximum pressure coefficient.- The maximum pressure coefficient on the  $180^\circ$  meridian is plotted against the apex deflection angle for each of the bodies in figure 8. Stagnation values of pressure coefficient occur for apex deflection angles equal to or greater than  $69^\circ$ ,  $65^\circ$ , and  $61^\circ$  for the parabolic-arc, circular-arc, and conical bodies, respectively. For apex deflection angles below these values, the maximum pressure coefficients decrease continuously toward the attached-shock value for each of the respective groups of bodies. It is of interest to note that this trend is similar to that found for the two-dimensional bodies reported in reference 4 except that the  $C_{p,\max}$  curves for the parabolic-arc and circular-arc bodies were coincident in the two-dimensional case. The maximum pressure coefficients that are predicted by the modified Newtonian theory using  $K = C_{p,\text{stag}}$  and  $K = \gamma + 1$  are also shown in figure 8 for comparison.

Figure 9 shows that on the  $0^\circ$  meridian all measured values of  $C_{p,\max}$  vary with apex half-angle and angle of attack. Only for the  $56^\circ$  bodies do the values of  $C_{p,\max}$  for all shapes investigated fall along the same curve and agree with the modified Newtonian theory ( $K = \gamma + 1$ ). As apex half-angle increases, the variation of  $C_{p,\max}$  with deflection angle approaches that predicted by modified Newtonian theory ( $K = C_{p,\text{stag}}$ ) until at  $\delta_a = 90^\circ$  the curved surface bodies agree with this theory as expected.

Location of maximum pressure coefficients.- The location of the maximum pressure coefficients would be expected to occur at the point (herein referred to as the geometric location) where the slope relative to the flow is the greatest. A comparison of the geometric and measured slopes at which the maximum pressures occurred on both the  $180^\circ$  and  $0^\circ$  meridians of the parabolic-arc and circular-arc bodies is shown in figure 10. It must be remembered that physical limitations prevented the installation of the first orifice exactly at the apex; therefore, in comparing the measured location with the geometric location of  $C_{p,\max}$ , the locations will be considered coincident whenever the measured locations differ from the geometric locations by the same difference as that indicated at  $0^\circ$  angle of attack. On the  $180^\circ$  meridian (fig. 10(a)), only for the  $90^\circ$  bodies do the measured and geometric locations coincide over the angle-of-attack range investigated. For all other bodies the measured location of  $C_{p,\max}$  moves rearward before the angle relative to the flow becomes  $90^\circ$ . This result is attributed to the pressure bleed-off around the apex. The maximum difference between the geometric and measured location of  $C_{p,\max}$  for any body through the angle-of-attack range of the tests is only about  $8^\circ$ . The same result was found for the two-dimensional bodies in reference 4. On the  $0^\circ$  meridian the location of the maximum pressure remained at the nose over the angle-of-attack range of the tests as expected and shown in figure 10(b).

Comparison of the  $180^\circ$  and  $0^\circ$  meridian pressure distributions on cones at corresponding deflection angles.- The  $180^\circ$  and  $0^\circ$  meridian pressure distributions in terms of the  $C_{p,l}/C_{p,\max}$  against  $s/s_c$  for cones at approximately constant surface-deflection angles are presented in figure 11. With few exceptions, at a given deflection angle the pressure distributions rearward of the maximum pressure point on the  $180^\circ$  and  $0^\circ$  meridians are essentially coincident with those of corresponding surfaces of cones having higher and lower half-angles, respectively. Since the values of  $C_{p,\max}$  on the  $180^\circ$  meridian are constant (fig. 11(a)), the pressure coefficients aft of the maximum pressure on this meridian at a given location of all cones at the same deflection angle are also coincident. However, on the  $0^\circ$  meridian the value of  $C_{p,\max}$  varies not only with deflection angle but also with cone angle. It should be noted that for  $\delta \geq 66^\circ$ , the distributions on the  $180^\circ$  and  $0^\circ$  meridians for the same  $\delta$  agree reasonably well.

Also included in figure 11 are flat-plate pressure distributions from reference 8 at approximately the same deflection angle as the cone surfaces. In general, the pressure distributions on the  $180^\circ$  and  $0^\circ$  meridians of the cones are in reasonably good agreement aft of the maximum pressure point with those of the flat plate at deflection angles of  $66^\circ$  and above. Since it was shown in reference 4 that the pressure distributions on the lower and upper surfaces of wedges were also in good agreement with those of a flat plate at deflection angles of  $66^\circ$  and above, the pressure distributions on cones are about the same as those on wedges at these deflection angles. In addition, the maximum pressure coefficients on the  $180^\circ$  meridian are the same as those on the flat plate (fig. 11(a)) and on the windward surface of wedges (ref. 4); therefore, the local pressure coefficients on these three configurations are coincident. The agreement in both the pressure level and distribution might not be envisioned since the three-dimensional variation of the flow over cones would be expected

to affect the pressure distributions differently than the two-dimensional variation of the flow over the flat plate and wedges.

### Correlation of Pressure Distributions by the Generalized Form of Newtonian Theory

Cones.- Since the prediction of the pressure distribution for any body by means of the generalized form of Newtonian theory is basically dependent upon the body having a changing slope, the theory obviously cannot be applied in the same manner to cones as to bodies having curved surfaces. However, it is shown in reference 3, that by using pressures computed from attached shock theory, the generalized form of Newtonian theory is applicable from one cone to another, for cone angles less than shock detachment at  $0^\circ$  angle of attack. For the aerodynamically blunt cones of the present investigation it is apparent from figure 6 that the large and varied pressure gradients prevent any correlation by the generalized form of Newtonian theory. Since the data of the present investigation cover the range of aerodynamically blunt cones, the pressure distribution of any cone in this regime can be obtained by interpolating these data. In addition, the good agreement in pressure distribution from cone to cone at the same deflection angles, as well as the agreement from cones to a flat plate and wedges to a flat plate at corresponding deflection angles, enables the pressure distribution to be obtained for any one configuration if either of the other two are known.

Parabolic- and circular-arc bodies.- The data for each meridian are reduced in the generalized form of the Newtonian theory by using their respective measured  $C_p,_{max}$  values. It should be noted that the  $45^\circ$  and  $135^\circ$  meridians contained only two orifices both of which were located at slopes considerably less than those of the apex half-angles. The results for the parabolic- and circular-arc models together with the generalized form of Newtonian theory prediction using the measured  $C_p,_{max}$  and the associated  $\delta_{max}$  are presented in figure 12. As can be seen from the figure, the data for both the parabolic-arc and circular-arc bodies throughout the angle-of-attack range were in general correlated very well. The exceptions are primarily the points along the  $45^\circ$  meridian (fig. 12(c)) which were noted before to be on the aft portion of the body and therefore would not necessarily correlate well because of their low deflection angles ( $\delta < 30^\circ$ ).

The agreement between the measured and theoretical values in percent of the measured  $C_p$  cannot be made directly from figure 12 because the values of  $C_p,_{max}$  are not constant for all bodies on any meridian. Therefore, a majority of the measured and predicted values of  $C_p$  together with their differences in percent of measured  $C_p$  are presented in table II. As might be expected, the agreement is best near the nose where the body slope is high, and becomes progressively poorer as the surface inclination decreases; however, the agreement does not become poorer than about 20 percent of the measured  $C_p$  down to a surface inclination of  $30^\circ$  (the limit to which modified Newtonian theory is known to predict the pressures very well on spheres). The very high percentage errors at inclinations below  $30^\circ$  may not be very significant because the pressures are

very low over this region. Some points between the nose and the maximum pressure point on the  $180^\circ$  and  $0^\circ$  meridians of some bodies at angle of attack other than  $0^\circ$  cannot be predicted by the generalized-Newtonian theory because the value of  $\sin^2\delta/\sin^2\delta_{\max}$  becomes greater than 1. But in considering all points above deflection angles of  $30^\circ$ , the theory predicts about 85 percent of the values within 10 percent of the measured  $C_p$ . The present investigation of the three-dimensional bodies indicates both types of bodies show about the same agreement, whereas for the two-dimensional aerodynamically blunt bodies of reference 4 the agreement for the circular-arc bodies was found to be better than that of the parabolic-arc bodies.

### Prediction of Pressure Distributions by the Generalized Form of Newtonian Theory

The present investigation showed that the pressure distributions of the aerodynamically blunt bodies having curved surfaces agree reasonably well with the generalized form of Newtonian theory. However, in order to use this theory without resorting to experimentation, it is necessary to know a pressure at a given slope on the surface. Since the measured locations (fig. 10) of the maximum pressures occur reasonably close to the geometric locations (with respect to the  $\sin^2\delta$ ) and because the maximum pressure on the lower surface is equal to stagnation value for the majority of deflection angles between shock detachment and  $90^\circ$  (fig. 8), it is convenient to utilize these conditions to predict the pressures over the whole body in the same manner as presented in reference 4 for two-dimensional aerodynamically blunt bodies. This can be accomplished as follows:

On the lower surface  $C_{p,\max} = C_{p,\text{stag}}$  for  $\delta_a \geq 65^\circ$  or  $\delta_a \geq 69^\circ$  for circular-arc and parabolic-arc bodies, respectively, whereas for apex deflection angles lower than those values,  $C_{p,\max}$  can be obtained from

$$\frac{C_{p,\max}}{C_{p,\text{stag}}} = \frac{\sin^2\delta_a}{\sin^2 65^\circ}$$

for the circular-arc bodies and

$$\frac{C_{p,\max}}{C_{p,\text{stag}}} = \frac{\sin^2\delta_a}{\sin^2 69^\circ}$$

for parabolic-arc bodies. The values of  $C_{p,\max}$  obtained in this manner for these deflection angles are shown in figure 8 and are in good agreement with the measured values. It should be noted that if an average value of  $67^\circ$  were used to find  $C_{p,\max}$  for both the parabolic-arc and circular-arc bodies,  $C_{p,\max}$  would vary by only 3 percent. For deflection angles equal to or less than shock detachment,  $C_{p,\max}$  is obtained from oblique shock theory.

The pressure distributions for the  $180^\circ$  meridian at any angle of attack can then be computed from

$$\frac{C_p}{C_{p,\max}} = \frac{\sin^2\delta}{\sin^2\delta_{\text{geom}}}$$

and the pressure distributions for all other meridians can be obtained at any angle of attack from

$$\frac{C_p}{C_{p,\max(\alpha=0^\circ)}} = \frac{\sin^2\delta}{\sin^2\delta_a(\alpha=0^\circ)}$$

provided the deflection angle on the respective meridian is less than the apex deflection angle at  $\alpha = 0^\circ$ .

The pressure coefficients predicted by this method (using  $65^\circ$  and  $69^\circ$  as the lower limits of  $C_{p,\text{stag}}$  for circular-arc and parabolic-arc bodies, respectively) are presented in table II. In general, these values are about the same as those obtained from the generalized form of Newtonian theory by using the measured values of  $C_{p,\max}$  at their actual locations on each surface and are within about 20 percent of the measured  $C_p$  at deflection angles above  $30^\circ$ . Some of the points between the nose and the actual location of the maximum pressure point, which could not be predicted by the generalized-Newtonian theory by using  $C_{p,\max}$  at its actual location for the  $180^\circ$  and  $0^\circ$  meridians, are not predicted by this method within this accuracy. However, on the whole, about 85 percent of all points at deflection angles above  $30^\circ$  are predicted within 10 percent of the measured  $C_p$  value.

Because of the lack of orifices on the  $45^\circ$  and  $135^\circ$  meridians it is recognized that the applicability of the equation is not completely established for these angles; however, the good results for the  $0^\circ$  and  $90^\circ$  meridians which are more completely covered tend to indicate that the equation is applicable as originally stated.

The good agreement between the generalized form of Newtonian theory and the data of the present investigation as well as the results for two-dimensional aerodynamically blunt bodies of reference 4 and for bodies having leading-edge or apex half-angles less than that for shock detachment of reference 3 indicate that this theory is applicable to all bodies having curved surfaces.

## CONCLUSIONS

An investigation of the applicability of the generalized form of Newtonian theory to three-dimensional bodies having apex half-angles greater than that for shock detachment at a Mach number of 6 and angles of attack up to  $25^\circ$  has resulted in the following conclusions:

1. A pressure equal to the stagnation value behind a normal shock was measured on conical, circular-arc, and parabolic-arc bodies having apex deflection angles equal to or greater than  $61^\circ$ ,  $65^\circ$ , and  $69^\circ$ , respectively, and between each of these angles and shock detachment angle the maximum pressure coefficient for each group of bodies decreases continuously with decreasing deflection angle.

2. With few exceptions the pressure distributions rearward of the maximum pressure point on the  $0^\circ$  and  $180^\circ$  meridians of aerodynamically blunt cones are primarily a function only of surface-deflection angle and essentially independent of the apex half-angles. In addition, the pressure distributions on these cones are in good agreement aft of the maximum pressure point with those of a flat plate and aerodynamically blunt wedges at corresponding deflection angles of  $66^\circ$  and above.

3. At all angles of attack for all aerodynamically blunt bodies having curved surfaces, the agreement between the generalized form of Newtonian theory and the measured values of pressure coefficient was reasonably good for surface-deflection angles above  $30^\circ$ . (For 85 percent of the values in this region the theoretical values of pressure coefficient were within 10 percent of the measured pressure coefficient.)

4. The generalized form of Newtonian theory can be used to predict the pressures on aerodynamically blunt contoured bodies because the maximum pressures and their locations can be predetermined reasonably well.

Langley Research Center,  
National Aeronautics and Space Administration,  
Langley Station, Hampton, Va., August 28, 1964.

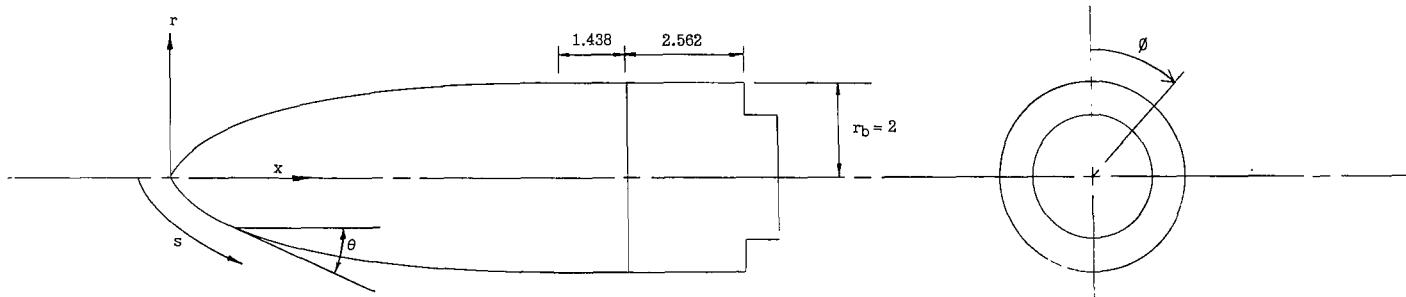
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TABLE I. - MODEL DIMENSIONS AND ORIFICE LOCATIONS

## (a) Parabolic-arc models



56° parabolic-arc model				
Orifice location		Slope θ, deg	s/r <sub>b</sub>	ϕ, deg
x, in.	r, in.			
0.057	0.081	54.29	0.050	180
.159	.214	51.32	.134	
.253	.331	48.73	.207	
.361	.467	45.56	.301	
.525	.606	42.28	.401	
.825	.851	36.30	.595	
1.157	1.059	31.38	.783	
1.520	1.264	25.79	1.000	
2.033	1.479	20.06	1.279	
2.777	1.701	13.72	1.675	
3.712	1.877	7.90	2.114	
4.146	1.928	5.76	2.362	
4.587	1.964	3.86	2.583	
5.028	1.987	2.16	2.804	
5.464	1.997	.68	3.022	
6.664	1.999	0.00	3.622	
.105	.134	53.02	.090	▼
.197	.256	50.35	.164	
.276	.352	48.20	.225	
.403	.487	45.06	.317	
.526	.605	42.27	.402	
.828	.852	36.26	.597	
1.141	1.058	31.07	.785	
1.500	1.266	25.91	.989	
2.037	1.480	20.02	1.281	
2.777	1.702	13.72	1.668	
3.716	1.878	7.88	2.115	
4.152	1.929	5.73	2.365	
4.593	1.965	3.83	2.586	
5.028	1.987	2.17	2.804	
5.463	1.996	.60	3.022	
5.860	1.998	0.00	3.222	
.822	.849	36.35	.594	▼
1.519	1.264	25.85	1.000	↓
.157	.212	51.36	.133	90
.255	.332	48.69	.209	
.528	.610	42.19	.403	
.823	.848	36.36	.594	
1.523	1.265	25.75	1.002	
.828	.853	36.25	.597	135
1.518	1.265	25.81	1.000	↓
.827	.849	36.30	.596	270
1.521	1.264	25.78	1.001	↓

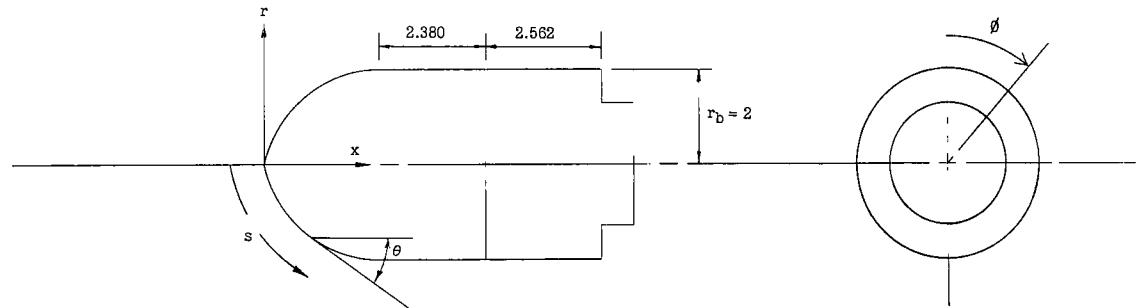
66° parabolic-arc model				
Orifice location		Slope θ, deg	s/r <sub>b</sub>	ϕ, deg
x, in.	r, in.			
0.019	0.037	64.78	0.023	180
.091	.177	60.19	.101	
.173	.321	55.48	.178	
.271	.445	51.47	.261	
.379	.571	46.97	.313	
.620	.795	39.45	.568	
.941	1.021	32.12	.706	
1.183	1.158	27.85	.845	
1.585	1.344	22.30	1.057	
2.085	1.521	17.21	1.332	
3.313	1.795	9.26	1.963	
4.002	1.887	6.31	2.311	
4.684	1.948	4.00	2.651	
5.362	1.982	2.14	2.992	
6.039	1.995	.60	3.331	
7.242	1.998	0.00	3.931	
.063	.123	61.95	.072	▼
.119	.225	58.59	.128	
.176	.319	55.49	.180	
.272	.446	51.17	.261	
.380	.567	47.04	.343	
.621	.792	39.52	.569	
.944	1.018	32.16	.708	
1.184	1.158	27.84	.846	
1.587	1.342	22.32	1.058	
2.085	1.518	17.24	1.332	
3.320	1.795	9.24	1.966	
4.003	1.887	6.31	2.311	
4.684	1.948	4.00	2.653	
5.366	1.982	2.14	2.994	
6.047	1.995	.59	3.335	
6.445	1.997	0.00	3.535	
.381	.569	47.00	.344	▼
1.181	1.153	27.95	.844	↓
.092	.176	60.21	.102	90
.174	.316	55.60	.179	
.271	.443	51.27	.261	
.380	.567	47.04	.344	
1.184	1.155	27.89	.846	
.381	.569	47.00	.344	135
1.179	1.154	27.95	.843	↓
.380	.569	47.00	.344	270
1.186	1.158	27.83	.847	↓

78° parabolic-arc model				
Orifice location		Slope θ, deg	s/r <sub>b</sub>	ϕ, deg
x, in.	r, in.			
0.005	0.022	76.50	0.012	180
.023	.088	72.00	.028	
.061	.182	65.63	.097	
.113	.284	58.86	.153	
.399	.606	40.13	.371	
.767	.856	29.11	.523	
1.296	1.099	20.90	.884	
2.015	1.327	14.87	1.261	
3.176	1.571	9.60	1.855	
4.395	1.758	6.41	2.470	
5.551	1.846	4.37	3.051	
6.714	1.919	2.88	3.634	
7.871	1.960	1.75	4.213	
9.026	1.989	.82	4.790	
10.196	1.999	.05	5.375	
11.274	2.000	0.00	5.915	
.027	.103	70.99	.052	▼
.065	.195	64.78	.102	
.103	.269	59.88	.144	
.234	.448	48.76	.256	
.395	.603	40.29	.368	
.771	.860	28.97	.596	
1.292	1.099	20.91	.882	
2.013	1.326	14.98	1.261	
3.232	1.580	9.41	1.884	
4.393	1.739	6.40	2.470	
5.549	1.847	4.37	3.050	
6.709	1.919	2.88	3.631	
7.867	1.961	1.75	4.211	
9.031	1.989	.81	4.793	
10.195	1.997	.05	5.375	
10.468	1.999	0.00	5.915	
.399	.607	40.11	.371	▼
1.296	1.099	20.90	.884	↓
.075	.215	63.14	.113	90
.116	.288	58.63	.156	
.241	.453	48.44	.261	
.400	.606	40.13	.371	
1.300	1.099	20.88	.877	
.401	.606	40.14	.372	135
1.296	1.097	20.93	.884	↓
.401	.604	40.22	.372	270
1.292	1.095	20.99	.882	↓

90° parabolic-arc model				
Orifice location		Slope θ, deg	s/r <sub>b</sub>	ϕ, deg
x, in.	r, in.			
0.000	0.002	89.90	0.016	180
.006	.089	85.02	.055	
.031	.187	79.14	.125	
.050	.304	72.16	.157	
.113	.454	62.76	.236	
.333	.747	45.39	.418	
.535	.920	36.49	.549	
.992	1.189	25.10	.811	
2.085	1.548	13.54	1.395	
3.127	1.741	8.33	1.914	
3.989	1.846	5.69	2.347	
4.838	1.916	3.75	2.783	
5.679	1.959	2.28	3.193	
6.522	1.985	1.09	3.614	
7.367	1.993	.13	4.035	
8.457	1.999	0.00	4.575	
.006	.086	85.22	.055	▼
.020	.179	79.74	.101	
.051	.302	72.23	.159	
.115	.453	62.81	.239	
.330	.743	45.57	.413	
.537	.921	36.43	.550	
.891	1.139	27.01	.756	
1.449	1.366	18.92	1.056	
2.090	1.548	13.52	1.388	
3.127	1.739	8.41	1.914	
3.997	1.845	5.68	2.351	
4.836	1.913	3.78	2.771	
5.679	1.955	2.50	3.193	
6.526	1.983	1.10	3.616	
7.366	1.993	.12	4.035	
7.655	1.996	0.00	4.175	
.324	.758	45.88	.412	45
.894	1.138	27.01	.757	↓
.045	.276	73.84	.149	90
.083	.388	66.90	.202	
.157	.527	58.39	.280	
.330	.742	45.64	.416	
.889	1.137	27.07	.754	↓
.325	.758	45.85	.413	135
.892	1.138	27.04	.756	↓
.335	.746	45.38	.420	270
.891	1.137	27.06	.756	↓

TABLE I.-- MODEL DIMENSIONS AND ORIFICE LOCATIONS - Continued

(b) Circular-arc models



56° circular-arc model					
Orifice location	Slope	$s/r_b$	$\phi$ , deg		
x, in.	r, in.				
0.021	0.035	55.48	0.021	180	
.080	.125	54.12	.076		
.145	.219	52.86	.134		
.264	.372	50.24	.233		
.385	.513	47.90	.326		
.534	.669	45.18	.454		
.692	.818	42.45	.541		
.860	.961	39.66	.651		
1.050	1.108	36.65	.770		
1.274	1.261	33.21	.905		
1.485	1.392	30.08	1.029		
2.066	1.677	21.90	1.356		
2.604	1.851	14.76	1.634		
3.155	1.950	7.96	1.881		
3.667	1.990	1.20	2.070		
4.743	2.000	0.00	2.610		
.070	.114	54.30	.069		
.134	.204	52.91	.125		
.215	.313	51.21	.194		
.326	.446	49.02	.281		
.443	.578	46.81	.370		
.571	.706	44.52	.460		
.691	.818	42.45	.542		
.866	.967	39.56	.655		
1.058	1.114	36.50	.775		
1.275	1.264	33.19	.906		
1.487	1.393	30.35	1.030		
2.075	1.681	21.78	1.384		
2.611	1.853	14.68	1.638		
2.851	1.902	11.83	1.719		
3.654	1.990	1.35	2.070		
3.947	1.998	0.00	2.210		
.381	.508	47.98	.382	45	
.861	.962	39.64	.650		
.083	.128	54.06	.078	90	
.143	.213	52.76	.131		
.270	.375	50.16	.235		
.397	.524	47.69	.333		
.867	.967	39.55	.655		
.379	.506	48.01	.321	135	
.861	.961	39.65	.651		
.254	.360	50.41	.225		
.888	.983	59.22	.668		

66° circular-arc model					
Orifice location	Slope	$\theta$ , deg	$s/r_b$	$\phi$ , deg	
x, in.	r, in.				
0.008	0.020	65.62	0.011	180	
.033	.114	64.00	.063		
.076	.225	62.00	.125		
.134	.339	59.85	.190		
.208	.463	57.42	.263		
.333	.644	53.73	.373		
.452	.796	50.48	.470		
.566	.924	47.59	.556		
.732	1.093	43.60	.676		
.872	1.219	40.43	.771		
1.075	1.380	36.07	.903		
1.293	1.524	31.64	1.035		
1.969	1.834	19.11	1.405		
2.466	1.954	10.44	1.664		
2.963	1.999	1.98	1.901		
3.993	2.000	0.00	2.441		
.034	.120	63.91	.066		
.081	.239	61.75	.133		
.120	.315	60.33	.176		
.205	.456	57.56	.259		
.291	.586	54.93	.338		
.388	.715	52.22	.418		
.488	.834	49.60	.496		
.602	.959	46.74	.580		
.723	1.082	43.84	.668		
.866	1.213	40.57	.766		
1.062	1.369	36.35	.894		
1.286	1.518	31.82	1.029		
1.956	1.829	19.34	1.402		
2.451	1.950	10.71	1.652		
2.958	1.996	2.13	1.865		
3.234	1.999	0.00	2.005		
.407	.738	51.71	.433		45
.826	1.171	41.48	.738		
.036	.123	63.84	.068		
.078	.228	61.94	.127		
.121	.467	57.35	.266		
.329	.637	53.87	.369		
.718	1.076	43.98	.663		
.406	.735	51.54	.431		135
.828	1.177	41.45	.738		
.402	.730	51.86	.428		270
.714	1.078	44.00	.664		

78° circular-arc model				
Orifice location	Slope $\theta$ , deg	$s/s_b$	$\phi$ , deg	
x, in.	r, in.			
0.008	0.032	77.25	0.018	180
.023	.115	75.33	.061	
.044	.207	73.31	.106	
.081	.312	70.68	.164	
.135	.453	67.27	.239	
.199	.586	63.93	.312	
.265	.706	60.81	.386	
.380	.890	55.90	.488	
.489	1.043	51.63	.583	
.588	1.162	48.12	.661	
.748	1.322	42.98	.773	
.970	1.508	36.42	.919	
1.158	1.635	31.26	1.033	
2.052	1.962	9.53	1.502	↓
2.364	1.995	1.94	1.645	
3.468	1.998	0.00	2.185	↓
.022	.120	75.22	.063	
.045	.214	73.04	.112	
.075	.311	70.75	.163	
.129	.446	67.46	.236	
.192	.576	64.19	.307	
.264	.704	60.87	.379	
.384	.841	57.23	.459	
.435	.968	53.72	.536	
.536	1.101	46.52	.621	
.634	1.212	46.52	.695	
.731	1.306	43.51	.762	
.947	1.491	37.05	.905	
1.136	1.622	31.85	1.021	
2.056	1.960	9.90	1.495	
2.370	1.995	2.26	1.641	
2.662	1.999	0.00	1.781	
.203	.594	63.73	317	↓
.380	.890	55.89	.488	↓
.022	.116	75.28	.061	90
.046	.209	73.15	.109	—
.139	.459	67.10	.243	—
.199	.584	63.97	.311	—
.380	.892	55.85	.490	—
.198	.585	63.96	.312	135
.379	.891	55.88	.489	↓
.181	.553	64.77	.294	270
.374	.884	58.08	.484	↓

90° circular-arc model					
Orifice location		Slope $\theta$ , deg	$s/r_b$	$\phi$ , deg	
x, in	r, in.				
0.000	0.010	89.71	0.005	130	
.003	.084	87.57	.042		
.010	.193	84.44	.096		
.028	.324	80.67	.162		
.055	.456	76.79	.230		
.095	.591	72.76	.299		
.137	.718	68.90	.367		
.212	.888	65.58	.460		
.276	1.009	59.64	.589		
.363	1.146	54.98	.610		
.501	1.323	48.54	.723		
.608	1.437	44.08	.801		
.825	1.621	35.91	.945		
1.505	1.914	14.30	1.327		
1.919	1.997	2.32	1.520		
3.007	2.000	0.00	2.060		
.002	.092	87.34	.046		
.009	.186	84.61	.093		
.021	.286	81.77	.143		
.040	.387	78.83	.194		
.073	.527	74.68	.267		
.109	.645	71.14	.328		
.176	.813	65.96	.418		
.231	.929	62.28	.483		
.312	1.069	57.64	.563		
.395	1.191	53.42	.637		
.503	1.324	48.49	.723		
.610	1.437	44.04	.801		
.830	1.622	35.79	.946		
1.511	1.910	14.14	1.325		
1.914	1.996	2.47	1.507		
2.194	1.999	0.00	1.647		
.092	.592	72.76	.300	45	
.212	.890	63.52	.461		
.002	.494	87.21	.004	90	
.010	.198	84.31	.099		
.056	.466	76.53	.235		
.092	.589	72.82	.299		
.213	.896	63.40	.463		
.096	.599	72.53	.304	155	
.215	.899	63.26	.466		
.096	.603	72.40	.306	270	
.222	.909	62.91	.471		

TABLE I.- MODEL DIMENSIONS AND ORIFICE LOCATIONS - Concluded

## (c) Conical models

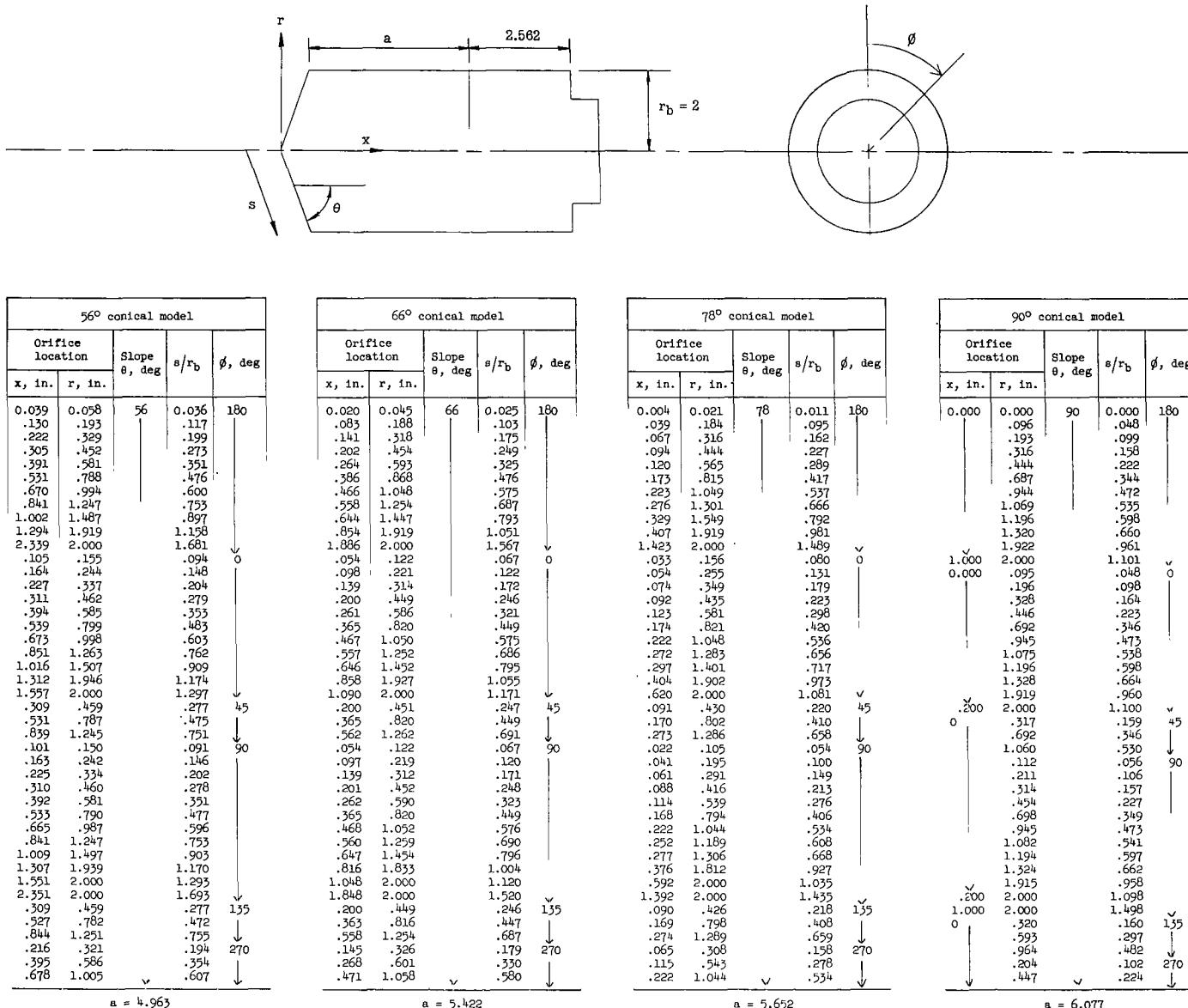


TABLE II.- MEASURED AND THEORETICAL VALUES OF PRESSURE COEFFICIENTS FOR  
THREE-DIMENSIONAL AERODYNAMICALLY BLUNT BODIES

(a) Parabolic-arc bodies;  $\phi = 180^\circ$  meridian

$\theta_a = 56^\circ$												$\theta_a = 66^\circ$												
$\alpha$ , deg	$\delta$ , deg	C <sub>p,meas</sub>	C <sub>p</sub>	C <sub>p</sub>	C <sub>p,meas - C<sub>p</sub></sub>	$\frac{C_{p,meas} - C_p}{C_{p,meas}}$	$\frac{C_{p,meas} - C_p}{C_{p,meas}}$	$\alpha$ , deg	$\delta$ , deg	C <sub>p,meas</sub>	C <sub>p</sub>	C <sub>p</sub>	C <sub>p,meas - C<sub>p</sub></sub>	$\frac{C_{p,meas} - C_p}{C_{p,meas}}$	$\frac{C_{p,meas} - C_p}{C_{p,meas}}$									
0	54.25	1.456	1.456	1.374	0	0.056		0	64.78	1.753	1.753	1.707	0									0.026		
	51.32	1.420	1.347	1.271	.054	.105			60.19	1.592	1.612	1.570	-.013									.013		
	48.73	1.143	1.249	1.179	-.092	-.031			55.49	1.317	1.454	1.416	-.104									-.075		
	45.57	1.044	1.127	1.064	-.080	-.019			51.47	1.188	1.310	1.277	-.103									-.075		
	42.28	.973	1.000	.944	-.028	.030			46.98	1.050	1.145	1.115	-.091									-.062		
	36.31	.704	.775	.731	-.101	-.038			39.46	.755	.865	.842	-.145									-.115		
	31.08	.519	.589	.556	-.135	-.071			32.12	.519	.605	.590	-.166									-.136		
	20.06	.236	.260	.246	-.102	-.041			22.30	.273	.308	.300	-.128									-.099		
	13.73	.135	.125	.118	.074	.126			9.26	.078	.056	.054	.286									.304		
	5.77	.046	.022	.021	.509	.537			2.15	.017	.003	.003	.827									.831		
	2.17	.023	.003	.003	.862	.870																		
5	59.25	1.616	1.616	1.541	0	.046		5	69.78	1.817	1.817	1.790	0									.015		
	56.32	1.530	1.515	1.444	.010	.056			65.19	1.692	1.701	1.675	-.005									.010		
	53.73	1.309	1.422	1.356	-.086	-.035			60.49	1.475	1.563	1.540	-.060									-.044		
	50.57	1.222	1.305	1.244	-.068	-.018			56.47	1.361	1.434	1.413	-.054									-.038		
	47.28	1.144	1.181	1.126	-.052	.016			51.98	1.222	1.281	1.262	-.048									-.032		
	41.31	.864	.953	.908	-.103	-.051			44.46	.920	1.012	.997	-.101									-.084		
	36.08	.668	.759	.723	-.135	-.082			37.12	.671	.752	.740	-.121									-.104		
	30.79	.515	.573	.546	-.112	-.060			32.85	.551	.607	.598	-.143									-.126		
	18.73	.208	.226	.215	-.082	-.032			22.22	.270	.295	.291	-.094									-.077		
	8.86	.068	.052	.050	.238	.272			11.31	.094	.079	.078	.152									.165		
	5.00	.028	.017	.016	.406	.434			5.00	.025	.016	.015	.379									.388		
10	64.25	1.736	1.736	1.692	0	.026		10	74.78	1.818	1.818	1.798	0									.011		
	61.32	1.634	1.647	1.605	-.008	.017			70.19	1.752	1.728	1.709	-.014									.025		
	58.73	1.468	1.563	1.524	-.065	-.038			65.49	1.592	1.620	1.598	-.018									-.004		
	55.57	1.386	1.455	1.419	-.050	-.024			61.47	1.482	1.507	1.490	-.017									-.006		
	52.28	1.256	1.359	1.305	-.042	-.015			56.98	1.349	1.372	1.357	-.017									-.006		
	46.31	1.030	1.119	1.090	-.086	-.059			49.46	1.066	1.127	1.115	-.057									-.046		
	41.08	.832	.924	.901	-.110	-.082			42.12	.812	.878	.868	-.081									-.069		
	35.79	.666	.732	.713	-.098	-.071			37.85	.672	.735	.727	-.094									-.082		
	30.06	.465	.537	.523	-.155	-.126			33.30	.506	.557	.551	-.102									-.090		
	17.91	.190	.202	.197	-.067	-.039			19.26	.200	.212	.210	-.060									-.049		
	10.00	.067	.065	.063	.035	.059			10.00	.060	.059	.058	-.019									.050		
15	69.25	1.818	1.818	1.778	0	.022		15	79.78	1.803	1.803	1.805										.001		
	66.32	1.739	1.744	1.706	-.003	.019			75.19	1.792	1.773	1.742	.011									.028		
	63.73	1.618	1.672	1.635	-.034	-.011			70.49	1.695	1.686	1.656	.056									.023		
	60.57	1.529	1.577	1.542	-.031	-.009			66.47	1.603	1.595	1.567	.049									.023		
	57.28	1.432	1.472	1.440	-.028	-.005			61.97	1.479	1.479	1.452	.001									.018		
	51.31	1.195	1.267	1.239	-.060	-.037			54.46	1.228	1.256	1.234	-.023									-.050		
	46.08	.993	1.079	1.055	-.086	-.062			47.12	.973	1.019	1.001	-.047									-.028		
	40.79	.828	.887	.868	-.072	-.049			42.85	.820	.878	.862	-.070									-.051		
	35.06	.605	.686	.671	-.133	-.108			37.30	.649	.697	.684	-.073									-.054		
	28.73	.421	.480	.470	-.140	-.115			32.22	.498	.539	.530	-.083									-.064		
	20.77	.237	.261	.256	-.103	-.079			21.31	.240	.251	.246	-.043									-.024		
	15.00	.123	.139	.136	-.137	-.112			15.00	.114	.127	.125	-.110									-.090		
20	74.25	1.818	1.818	1.788	0	.016		20	84.78	1.762	1.762	1.812										-.029		
	71.32	1.768	1.761	1.733	.004	.020			80.19	1.817	1.814	1.774	.001									.023		
	68.73	1.692	1.704	1.677	-.007	.009			75.22	1.770	1.751	1.713	.011									.033		
	75.57	1.612	1.626	1.600	-.009	.008			71.47	1.697	1.680	1.643	.010									.032		
	62.28	1.525	1.538	1.513	-.009	.008			66.98	1.602	1.583	1.548	.012									.034		
	56.31	1.321	1.359	1.337	-.028	-.012			59.46	1.381	1.386	1.355	-.002									.020		
	51.08	1.139	1.188	1.169	-.043	-.026			52.12	1.141	1.164	1.139	-.020									.002		
	45.79	.974	1.008	.992	-.035	-.019			47.85	.987	1.027	1.004	-.040									-.018		
	40.06	.740	.813	.800	-.099	-.081			42.50	.803	.846	.828	-.054									-.031		
	33.73	.543	.605	.595	-.114	-.096			37.22	.644	.683	.668	-.062									-.023		
	25.77	.334	.371	.365	-.110	-.092			29.26	.417	.438	.437	-.050									-.047		
	20.00	.199	.230	.226	-.153	-.134			20.00	.188	.219	.214	-.164									-.139		
25	79.25	1.818	1.818	1.780	0	.011		25	89.78	1.666	1.666	1.818										-.009		
	76.32	1.797	1.778	1.759	.010	.021			85.19	1.797	1.805	1.768	-.002									-.005		
	73.73	1.749	1.736	1.717	.007	.018			80.49	1.797	1.800	1.768	-.016									.016		
	70.57	1.691	1.675	1.657	.009	.020			76.47	1.755	1.749	1.719	.034									.021		
	67.28	1.620	1.603	1.586	.011	.021			71.98	1.602	1.673	1.644	.005									.023		
	61.31	1.451	1.450	1.434	0	.012			64.46	1.498	1.506	1.480	-.005									.012		
	56.08	1.287	1.298	1.283	-.008	.003			57.12	1.286	1.305	1.282	-.015											

TABLE III.- MEASURED AND THEORETICAL VALUES OF PRESSURE COEFFICIENTS FOR  
THREE-DIMENSIONAL AERODYNAMICALLY BLUNT BODIES - Continued

(a) Parabolic-arc bodies;  $\phi = 180^\circ$  meridian - Concluded

$\theta_a = 78^\circ$												$\theta_a = 90^\circ$											
$\alpha$ , deg	$\delta$ , deg	$C_p$ ,meas	$C_p$ (a)	$C_p$ (b)	$\frac{C_p,\text{meas} - C_p}{C_p,\text{meas}}$ (a)	$\frac{C_p,\text{meas} - C_p}{C_p,\text{meas}}$ (b)	$\alpha$ , deg	$\delta$ , deg	$C_p$ ,meas	$C_p$ (a)	$C_p$ (b)	$\frac{C_p,\text{meas} - C_p}{C_p,\text{meas}}$ (a)	$\frac{C_p,\text{meas} - C_p}{C_p,\text{meas}}$ (b)										
0	76.51	1.818	1.818	1.797	0	0.012	0	89.90	1.818	1.818	1.818	0	0	0	0	0	0	0	0	0	0	0	0
	72.01	1.733	1.740	1.719	-.004	.008		85.03	1.798	1.805	1.805	1.805	-.004	-.004	-.004	-.004	-.004	-.004	-.004	-.004	-.004	-.004	-.004
	65.64	1.569	1.596	1.577	-.017	-.005		79.15	1.737	1.754	1.754	1.754	-.010	-.010	-.010	-.010	-.010	-.010	-.010	-.010	-.010	-.010	-.010
	58.87	1.407	1.409	1.393	-.001	.010		72.17	1.620	1.648	1.648	1.648	-.017	-.017	-.017	-.017	-.017	-.017	-.017	-.017	-.017	-.017	-.017
	40.14	.791	.799	.790	-.011	.001		62.77	1.362	1.437	1.437	1.437	-.055	-.055	-.055	-.055	-.055	-.055	-.055	-.055	-.055	-.055	-.055
	29.11	.435	.455	.450	-.047	-.035		45.39	.881	.922	.922	.922	-.046	-.046	-.046	-.046	-.046	-.046	-.046	-.046	-.046	-.046	-.046
	20.91	.240	.245	.242	.022	-.010		36.50	.595	.645	.645	.645	-.081	-.081	-.081	-.081	-.081	-.081	-.081	-.081	-.081	-.081	-.081
	14.87	.145	.127	.125	.128	.158		25.11	.322	.327	.327	.327	-.017	-.017	-.017	-.017	-.017	-.017	-.017	-.017	-.017	-.017	-.017
	6.41	.042	.024	.024	.423	.430		13.54	.130	.100	.100	.100	.234	.234	.234	.234	.234	.234	.234	.234	.234	.234	.234
	1.76	.005	.002	.002	.669	.672		5.69	.045	.018	.018	.018	.600	.600	.600	.600	.600	.600	.600	.600	.600	.600	.600
5	81.51	1.819	1.819	1.806	0	.007	5	94.90	1.792	1.805	1.805	1.805	-.007	-.007	-.007	-.007	-.007	-.007	-.007	-.007	-.007	-.007	-.007
	77.01	1.758	1.765	1.753	.010	.017		90.03	1.810	1.808	1.818	1.818	.001	.001	.001	.001	.001	.001	.001	.001	.001	.001	.001
	70.64	1.667	1.657	1.643	.006	.014		84.15	1.789	1.799	1.799	1.799	-.006	-.006	-.006	-.006	-.006	-.006	-.006	-.006	-.006	-.006	-.006
	63.87	1.523	1.499	1.488	.016	.023		77.17	1.709	1.728	1.728	1.728	-.011	-.011	-.011	-.011	-.011	-.011	-.011	-.011	-.011	-.011	-.011
	45.14	.945	.934	.928	.012	.019		67.77	1.506	1.558	1.558	1.558	-.035	-.035	-.035	-.035	-.035	-.035	-.035	-.035	-.035	-.035	-.035
	34.11	.597	.585	.581	-.050	-.043		50.39	1.505	1.079	1.079	1.079	-.023	-.023	-.023	-.023	-.023	-.023	-.023	-.023	-.023	-.023	-.023
	25.91	.354	.357	.352	-.069	-.054		41.50	.747	.798	.798	.798	-.068	-.068	-.068	-.068	-.068	-.068	-.068	-.068	-.068	-.068	-.068
10	14.60	.127	.118	.117	.070	.076	10	30.11	.443	.458	.458	.458	-.034	-.034	-.034	-.034	-.034	-.034	-.034	-.034	-.034	-.034	-.034
	5.00	.013	.014	.014	-.043	-.042		18.54	.184	.183	.184	.184	.002	.002	.002	.002	.002	.002	.002	.002	.002	.002	.002
	86.51	1.788		1.814		-.015		5.13	.024	.015	.015	.015	.389	.389	.389	.389	.389	.389	.389	.389	.389	.389	.389
	82.01	1.813	1.809	1.786	.002	.015		99.90	1.755	1.764	1.764	1.764	-.005	-.005	-.005	-.005	-.005	-.005	-.005	-.005	-.005	-.005	-.005
	75.64	1.758	1.731	1.709	.015	.028		89.15	1.811	1.817	1.817	1.817	-.003	-.003	-.003	-.003	-.003	-.003	-.003	-.003	-.003	-.003	-.003
	68.87	1.640	1.605	1.584	.022	.034		82.17	1.780	1.787	1.787	1.787	-.004	-.004	-.004	-.004	-.004	-.004	-.004	-.004	-.004	-.004	-.004
	50.14	1.124	1.087	1.073	.033	.045		72.77	1.627	1.658	1.658	1.658	-.019	-.019	-.019	-.019	-.019	-.019	-.019	-.019	-.019	-.019	-.019
15	39.11	.710	.734	.724	-.033	-.020	15	55.39	1.206	1.231	1.231	1.231	-.021	-.021	-.021	-.021	-.021	-.021	-.021	-.021	-.021	-.021	-.021
	30.91	.456	.487	.481	-.067	-.053		46.50	.908	.956	.956	.956	-.053	-.053	-.053	-.053	-.053	-.053	-.053	-.053	-.053	-.053	-.053
	19.60	.191	.208	.205	-.089	-.075		35.11	.577	.601	.601	.601	-.042	-.042	-.042	-.042	-.042	-.042	-.042	-.042	-.042	-.042	-.042
	10.00	.049	.056	.055	-.128	-.114		23.54	.273	.290	.290	.290	-.060	-.060	-.060	-.060	-.060	-.060	-.060	-.060	-.060	-.060	-.060
	91.51	1.722		1.818		-.055		10.00	.055	.055	.055	.055	-.011	-.011	-.011	-.011	-.011	-.011	-.011	-.011	-.011	-.011	-.011
	87.01	1.804	1.814			-.006																	
	80.64	1.793	1.785	1.771	.004	.013																	
20	73.87	1.721	1.692	1.678	.017	.002	20	104.90	1.670	1.698	1.698	1.698	-.017	-.017	-.017	-.017	-.017	-.017	-.017	-.017	-.017	-.017	-.017
	55.14	1.282	1.235	1.225	.037	.045		100.03	1.754	1.763	1.763	1.763	-.005	-.005	-.005	-.005	-.005	-.005	-.005	-.005	-.005	-.005	-.005
	44.11	.882	.888	.881	-.007	.001		94.15	1.799	1.809	1.809	1.809	-.006	-.006	-.006	-.006	-.006	-.006	-.006	-.006	-.006	-.006	-.006
	35.91	.611	.631	.626	-.052	-.023		87.17	1.805	1.814	1.814	1.814	-.005	-.005	-.005	-.005	-.005	-.005	-.005	-.005	-.005	-.005	-.005
	29.87	.435	.455	.451	-.045	-.036		77.77	1.722	1.736	1.736	1.736	-.004	-.004	-.004	-.004	-.004	-.004	-.004	-.004	-.004	-.004	-.004
	21.41	.222	.244	.242	-.100	-.091		60.39	1.369	1.374	1.374	1.374	-.030	-.030	-.030	-.030	-.030	-.030	-.030	-.030	-.030	-.030	-.030
	15.00	.110	.123	.122	-.117	-.107		51.50	1.080	1.113	1.113	1.113	-.030	-.030	-.030	-.030	-.030	-.030	-.030	-.030	-.030	-.030	-.030
25	96.51	1.627		1.601		.016	25	20.69	.211	.227	.227	.227	-.087	-.087	-.087	-.087	-.087	-.087	-.087	-.087	-.087	-.087	-.087
	92.01	1.763	1.763	1.817		-.030		15.00	.112	.122	.122	.122	-.075	-.075	-.075	-.075	-.075	-.075	-.075	-.075	-.075	-.075	-.075
	85.64	1.811	1.817	1.808	-.003	.001		109.90	1.585	1.607	1.607	1.607	0	0	0	0	0	0	0	0	0	0	0
	78.87	1.784	1.760	1.751	.014	.019		105.03	1.697	1.696	1.696	1.696	0	0	0	0	0	0	0	0	0	0	0
	60.14	1.421	1.375	1.368	.033	.037		99.15	1.772	1.772	1.772	1.772	0	0	0	0	0	0	0	0	0	0	0
	49.11	1.052	1.045	1.040	.007	.012		92.17	1.812	1.816	1.816	1.816	0	0	0	0	0	0	0	0	0	0	0
	40.91	.760	.784	.780	-.031	-.026		82.77	1.794	1.799	1.799	1.799	0	0	0	0	0	0	0	0	0	0	0
25	34.87	.573	.597	.594	-.043	-.038	25	65.39	1.513	1.503	1.503	1.503	.006	.006	.006	.006	.006	.006	.006	.006	.006	.006	.006
	29.60	.420	.446	.444	-.061	-.055		56.50	1.256	1.264	1.264	1.264	-.007	-.007	-.007	-.007	-.007	-.007	-.007	-.007	-.007	-.007	-.007
	20.00	.179	.214	.213	-.192	-.186		45.11	.900	.913	.913	.913	-.014	-.014	-.014	-.014	-.014	-.014	-.014	-.014	-.014	-.014	-.014
	101.51	1.501		1.745		-.272		33.54	.524	.555	.555	.555	-.059	-.059	-.059	-.059	-.059	-.059	-.059	-.059	-.059	-.059	-.059
	97.01	1.703		1.791		-.051		28.34	.386	.410	.410	.410	-.061	-.061	-.061	-.061	-.061	-.061	-.061	-.061	-.061	-.061	-.061
	90.64	1.806		1.818		-.006		20.00	.185	.213	.213	.2											

TABLE II.- MEASURED AND THEORETICAL VALUES OF PRESSURE COEFFICIENTS FOR  
THREE-DIMENSIONAL AERODYNAMICALLY BLUNT BODIES - Continued

(b) Parabolic-arc bodies;  $\phi = 0^\circ$  meridian

$\theta_a = 56^\circ$										$\theta_a = 66^\circ$									
$\alpha$ , deg	$\delta$ , deg	$C_p$ ,meas	$C_p$ (a)	$C_p$ (c)	$C_p$ ,meas - $C_p$		$C_p$ ,meas - $C_p$		$\alpha$ , deg	$\delta$ , deg	$C_p$ ,meas	$C_p$ (a)	$C_p$ (c)	$C_p$ ,meas - $C_p$		$C_p$ ,meas - $C_p$			
					$C_p$ ,meas	(a)	$C_p$ ,meas	(c)						$C_p$ ,meas	(a)	$C_p$ ,meas	(c)		
0	53.02	1.460	1.460	1.331	0	0.088	0	0.080	0	61.96	1.647	1.647	1.625	0	0.017	0.013	0.017	-.004	
	50.35	1.345	1.357	1.237	-.009	.080	-.074	.020		58.60	1.514	1.540	1.520	-.017	-.017	-.017	-.017	-.084	
	48.21	1.184	1.272	1.160	-.104	.020	-.104	-.006		55.50	1.307	1.436	1.417	-.098	-.098	-.098	-.098	-.076	
	45.07	1.039	1.147	1.045	-.104	-.006	-.103	-.005		51.18	1.177	1.283	1.266	-.090	-.090	-.090	-.090	-.067	
	42.27	.939	1.035	.944	-.103	-.005	-.103	-.005		47.05	1.048	1.133	1.118	-.081	-.081	-.081	-.081	-.067	
	36.26	.695	.800	.729	-.152	-.049	-.152	-.049		39.53	.770	.856	.845	-.113	-.113	-.113	-.113	-.097	
	31.07	.507	.609	.555	-.201	-.090	-.201	-.090		32.16	.513	.599	.591	-.168	-.168	-.168	-.168	-.152	
	25.92	.375	.437	.398	-.166	-.061	-.166	-.061		27.85	.400	.481	.455	-.153	-.153	-.153	-.153	-.138	
	13.72	.133	.129	.117	.029	.120	.120	.029		17.25	.113	.186	.187	-.641	-.641	-.641	-.641	-.655	
	2.17	.019	.003	.003	.830	.842	.842	.830		6.32	.048	.026	.025	.893	.893	.893	.893	.479	
5	48.02	1.265	1.265	1.153	0	.089	0	.089	5	56.96	1.528	1.528	1.466	0	.041	.041	.041	.026	
	45.35	1.192	1.158	1.056	.028	.114	.044	.044		53.60	1.387	1.408	1.351	-.016	-.016	-.016	-.016	-.099	
	43.21	1.023	1.113	.978	-.088	.044	-.044	-.044		50.50	1.130	1.294	1.242	-.146	-.146	-.146	-.146	-.100	
	40.07	.849	.948	.864	-.117	-.018	-.117	-.018		46.18	.987	1.132	1.086	-.147	-.147	-.147	-.147	-.100	
	37.27	.747	.839	.765	-.124	-.024	-.124	-.024		42.05	.866	.975	.936	-.126	-.126	-.126	-.126	-.081	
	31.26	.536	.616	.561	-.150	-.046	-.150	-.046		34.53	.611	.698	.670	-.143	-.143	-.143	-.143	-.097	
	26.07	.376	.442	.403	-.175	-.072	-.175	-.072		27.16	.390	.453	.435	-.161	-.161	-.161	-.161	-.115	
	15.02	.151	.154	.140	-.019	.073	-.019	.073		17.32	.102	.193	.185	-.885	-.885	-.885	-.885	-.814	
	2.89	.028	.006	.005	.792	.821	.821	.792		4.24	.038	.012	.011	.687	.687	.687	.687	.711	
	10	43.02	1.086	1.086	.969	0	.108	0	10	51.96	1.382	1.382	1.294	0	.064	.064	.064	.065	
10	40.35	1.021	.978	.874	.042	.144	.080	.080	10	48.60	1.256	1.253	1.174	.002	.002	.002	.002	.096	
	38.21	.867	.892	.798	-.029	.080	-.080	-.080		45.50	.968	1.133	1.061	-.171	-.171	-.171	-.171	-.129	
	35.07	.693	.770	.689	-.111	.006	-.111	-.006		41.18	.801	.966	.904	-.205	-.205	-.205	-.205	-.100	
	32.27	.589	.665	.594	-.129	-.008	-.129	-.008		37.05	.688	.809	.757	-.176	-.176	-.176	-.176	-.100	
	26.26	.401	.457	.408	-.137	-.017	-.137	-.017		29.53	.465	.541	.507	-.164	-.164	-.164	-.164	-.090	
	15.92	.178	.175	.157	-.016	.118	-.016	.118		17.85	.041	.209	.196	-.405	-.405	-.405	-.405	-.3780	
	3.72	.037	.010	.009	.733	.757	.757	.733		7.25	.068	.035	.033	.478	.478	.478	.478	.515	
	15	38.02	.909	.909	.791	0	.130	0	15	46.96	1.193	1.193	1.114	0	.066	.066	.066	.065	
	35.35	.845	.802	.698	.051	.174	.051	.174	43.60	1.107	1.062	.992	.041	.041	.041	.041	.104		
	33.21	.706	.757	.626	-.072	.113	-.072	.113	40.50	.853	.942	.880	-.104	-.104	-.104	-.104	-.032		
20	30.07	.550	.601	.524	-.092	.047	-.092	-.092	20	36.18	.653	.778	.727	-.191	-.191	-.191	-.191	-.113	
	27.27	.458	.503	.438	-.098	.044	-.098	-.098		32.05	.537	.629	.587	-.170	-.170	-.170	-.170	-.093	
	16.07	.185	.184	.160	.006	.135	.006	.135		24.53	.348	.385	.360	-.106	-.106	-.106	-.106	-.034	
	5.02	.049	.018	.016	.627	.674	.674	.627		12.85	.136	.110	.103	.191	.191	.191	.191	.243	
	33.02	.719	.719	.619	0	.139	0	.139		2.25	.035	.003	.003	.902	.902	.902	.902	.914	
	30.35	.656	.618	.532	-.058	.189	-.058	.189		41.96	.997	.997	.933	0	.064	.064	.064	.064	
	25.07	.406	.429	.374	-.056	.079	-.056	.079		38.60	.927	.868	.812	.064	.064	.064	.064	.124	
	16.26	.197	.190	.164	.038	.168	.038	.168		35.50	.683	.752	.715	-.101	-.101	-.101	-.101	-.047	
	5.92	.065	.026	.022	.606	.662	.662	.606		31.18	.510	.598	.559	-.172	-.172	-.172	-.172	-.096	
25	28.02	.561	.561	.460	0	.180	0	.180	25	19.53	.247	.249	.233	-.139	-.139	-.139	-.139	-.064	
	25.35	.507	.465	.382	.082	.247	-.056	.247		7.85	.082	.042	.039	.492	.492	.492	.492	.524	
	23.21	.409	.427	.324	-.043	.208	-.043	.208		27.05	.405	.461	.431	-.010	-.010	-.010	-.010	.057	
	17.27	.234	.224	.184	.046	.214	-.046	.214		35.60	.748	.678	.639	.094	.094	.094	.094	.146	
	6.07	-.075	.028	.023	.622	1.302	1.302	.622		30.50	.543	.570	.538	-.050	-.050	-.050	-.050	.009	
	28.02	.561	.561	.460	0	.180	0	.180		26.18	.393	.431	.406	-.097	-.097	-.097	-.097	-.033	
	25.35	.507	.465	.382	.082	.247	-.056	.247		14.53	.174	.139	.131	.201	.201	.201	.201	.247	
	23.21	.409	.427	.324	-.043	.208	-.043	.208		2.85	.053	.005	.005	.896	.896	.896	.896	.906	

a,c See footnotes at end of table.

TABLE II.-- MEASURED AND THEORETICAL VALUES OF PRESSURE COEFFICIENTS FOR  
THREE-DIMENSIONAL AERODYNAMICALLY BLUNT BODIES - Continued

(b) Parabolic-arc bodies;  $\phi = 0^\circ$  meridian - Concluded

$\theta_a = 78^\circ$										$\theta_a = 90^\circ$									
$\alpha$ , deg	$\delta$ , deg	$C_p$ ,meas	$C_p$	$C_p$	$\frac{C_p,\text{meas} - C_p}{C_p,\text{meas}}$	$\frac{C_p,\text{meas} - C_p}{C_p,\text{meas}}$	$\alpha$ , deg	$\delta$ , deg	$C_p$ ,meas	$C_p$	$C_p$	$C_p$	$C_p$	$C_p$	$\frac{C_p,\text{meas} - C_p}{C_p,\text{meas}}$	$\frac{C_p,\text{meas} - C_p}{C_p,\text{meas}}$			
(a)	(c)	(a)	(c)	(a)	(c)	(a)	(c)	(a)	(c)	(a)	(c)	(a)	(c)	(a)	(c)	(a)	(c)		
0	70.99	1.724	1.724	1.698	0	.015	0	85.22	1.804	1.806	0					-0.001			
	64.79	1.557	1.579	1.555	-.014	.001	79.74	1.743	1.759	1.761	-.009					-.010			
	59.88	1.421	1.443	1.422	-.016	-.001	72.23	1.612	1.647	1.649	-.022					-.023			
	48.76	1.069	1.091	1.075	-.020	-.006	62.81	1.407	1.437	1.459	-.021					-.022			
	40.30	.798	.807	.795	-.011	.004	45.58	.867	.927	.928	-.068					-.069			
	28.97	.442	.452	.446	-.023	-.009	36.43	.622	.641	.641	-.029					-.030			
	20.91	.246	.246	.242	.001	.016	27.02	.379	.375	.375	.011					.010			
	9.42	.073	.052	.051	.290	.501	18.92	.205	.191	.191	.068					.067			
	1.76	.006	.002	.002	.682	.667	8.41	.071	.059	.059	.451					.450			
							2.31	.017	.003	.003	.830					.830			
5	65.99	1.609	1.609	1.586	0	.014	5	80.22	1.743	1.743	1.766	0				-.013			
	59.79	1.404	1.440	1.419	-.026	-.011	74.74	1.650	1.670	1.692	-.012					-.026			
	54.88	1.261	1.290	1.271	-.023	-.008	67.23	1.478	1.526	1.546	-.032					-.046			
	45.76	.894	.922	.909	-.031	-.017	57.81	1.250	1.285	1.302	-.028					-.042			
	35.30	.634	.644	.634	-.012	0	40.58	.707	.759	.769	-.074					-.088			
	23.97	.318	.318	.314	-.002	.013	31.43	.481	.488	.494	-.014					-.028			
	15.91	.162	.145	.143	.105	.117	22.02	.280	.292	.296	.099					.087			
	4.42	.055	.011	.011	.675	.686	13.92	.142	.104	.105	.269					.259			
							3.41	.037	.006	.006	.827					.824			
10	60.99	1.475	1.475	1.453	0	.015	10	75.22	1.668	1.668	1.699	0				-.019			
	54.79	1.245	1.287	1.268	-.034	-.018	69.74	1.551	1.570	1.599	-.012					-.031			
	49.88	1.090	1.128	1.111	-.034	-.019	62.23	1.344	1.397	1.423	-.039					-.059			
	38.76	.735	.756	.745	-.027	-.014	52.81	1.094	1.132	1.154	-.035					-.055			
	30.30	.492	.491	.484	.006	.016	35.58	.565	.604	.615	-.070					-.090			
	18.97	.225	.204	.201	.095	.107	26.43	.368	.353	.360	-.039					-.021			
	10.91	.109	.097	.068	.110	.376	8.92	.093	.043	.044	.540					.531			
	4.89	.049	.014	.014	.712	.714	3.52	.048	.007	.007	.860					.858			
15	55.99	1.323	1.323	1.305	0	.013	15	70.22	1.556	1.556	1.610	0				-.034			
	49.79	1.073	1.123	1.108	-.047	-.032	64.74	1.418	1.438	1.487	-.014					-.049			
	44.88	.915	.959	.946	-.048	-.034	57.23	1.188	1.213	1.285	-.046					-.082			
	33.76	.582	.595	.587	-.023	-.009	47.81	.925	.965	.998	-.043					-.079			
	25.30	.371	.352	.347	.097	.065	30.58	.445	.455	.471	-.022					-.057			
	15.97	.153	.112	.111	.268	.275	21.43	.273	.235	.243	.140					.110			
	5.91	.066	.020	.020	.691	.697	12.02	.138	.076	.079	.446					.427			
							3.92	.055	.008	.008	.851					.846			
20	50.99	1.150	1.150	1.148	0	.002	20	65.22	1.447	1.447	1.499	0				-.036			
	44.79	.893	.946	.943	-.059	-.056	59.74	1.281	1.309	1.356	-.020					-.057			
	39.88	.746	.783	.781	-.049	-.047	52.23	1.039	1.097	1.136	-.055					-.093			
	28.76	.445	.441	.440	.008	.011	42.81	.772	.810	.840	-.050					-.088			
	20.30	.268	.229	.229	.150	.146	25.58	.340	.327	.339	.037					.002			
	8.97	.104	.046	.046	.557	.558	16.43	.202	.140	.145	.305					.280			
							7.02	.092	.027	.028	.716					.691			
25	45.99	.980	.980	.983	0	-.003	25	60.22	1.290	1.290	1.370	0				-.062			
	39.79	.719	.776	.778	-.079	-.062	54.74	1.120	1.142	1.212	-.019					-.083			
	34.88	.594	.619	.621	-.042	-.045	47.23	.865	.923	.980	-.067					-.133			
	23.76	.332	.307	.309	.075	.069	37.81	.617	.643	.683	-.044					-.107			
	15.30	.194	.132	.132	.325	.320	20.58	.242	.212	.225	.125					.071			
	3.97	.066	.009	.009	.375	.833	11.43	.131	.067	.071	.488					.455			
							2.02	.053	.002	.003	.960					.950			

a,cSee footnotes at end of table.

TABLE II.- MEASURED AND THEORETICAL VALUES OF PRESSURE COEFFICIENTS FOR  
THREE-DIMENSIONAL AERODYNAMICALLY BLUNT BODIES - Continued

(c) Parabolic-arc bodies;  $\phi = 45^\circ, 90^\circ, 135^\circ$  meridians

$\theta_A = 56^\circ$												$\theta_B = 66^\circ$					
$\alpha$ , deg	$\phi$ , deg	$\delta$ , deg	$C_p, \text{meas}$	$C_p$	$C_p, \text{meas} - C_p$	$C_p, \text{meas} - C_p$	$C_p, \text{meas}$	$\alpha$ , deg	$\phi$ , deg	$\delta$ , deg	$C_p, \text{meas}$	$C_p$	$C_p, \text{meas} - C_p$	$C_p, \text{meas}$	$C_p, \text{meas}$	$C_p, \text{meas} - C_p$	
			(a)	(c)	(a)	(c)					(a)	(c)	(a)	(c)	(a)	(c)	
0	45	36.35	0.719	0.719	0.732	0	-0.018	0	45	47.00	1.111	1.111	1.115	0	-0.004	-0.004	
	25.80	.401	.388	.395	.032	.015	.015		27.95	.433	.456	.458	.458	-.053	-.058		
90	51.37	1.455	1.455	1.273	0	.124	.124	90	60.22	1.663	1.663	1.571	0	.055	.055		
	48.70	1.208	1.344	1.177	-.113	.026	.026		55.60	1.378	1.503	1.420	1.420	-.091	-.050		
135	42.18	.947	.074	.941	-.156	.006	.006		51.27	1.283	1.344	1.269	1.269	-.048	.011		
	36.37	.734	.837	.733	-.140	.001	.001		47.05	1.144	1.182	1.118	1.118	-.033	.023		
135	25.75	.408	.149	.394	-.100	.034	.034		27.90	.437	.483	.457	.457	-.106	-.046		
	36.25	.700	.700	.729	0	-.041	-.041	135	47.00	1.122	1.122	1.115	0	.006	.006		
135	25.82	.406	.380	.396	.062	.025	.025		27.95	.427	.461	.458	.458	-.080	-.073		
5	45	32.73	.597	.597	.610	0	-.022	5	45	43.35	.940	.940	.983	0	-.046		
	22.22	.307	.292	.298	.049	.029	.029		24.35	.332	.339	.355	.355	.021	-.069		
90	51.10	1.395	1.395	1.263	0	.095	.095	90	59.83	1.578	1.578	1.561	0	.011	.011		
	48.45	1.167	1.290	1.168	-.105	-.001	-.001		55.28	1.304	1.426	1.409	1.409	-.093	-.081		
135	42.00	.921	1.031	.934	-.119	.014	.014		51.00	1.219	1.275	1.260	1.260	-.046	-.034		
	36.20	.707	.804	.728	-.137	-.030	-.030		46.82	1.084	1.122	1.109	1.109	-.035	-.023		
135	25.65	.398	.432	.391	-.085	.018	.018		27.78	.420	.459	.453	.453	-.093	-.079		
	39.70	.801	.801	.851	0	-.062	-.062	135	50.42	1.195	1.195	1.239	0	-.037	-.037		
135	29.30	.485	.470	.500	.031	-.031	-.031		31.43	.509	.547	.567	.567	-.075	-.114		
10	45	29.00	.486	.486	.490	0	-.008	10	45	39.53	.794	.794	.845	0	-.064		
	18.55	.237	.209	.211	.118	.110	.110		20.65	.250	.244	.259	.259	.024	-.036		
90	50.28	1.311	1.311	1.234	0	.059	.059	90	58.73	1.495	1.495	1.524	0	.019	.019		
	47.72	1.125	1.213	1.142	.078	-.015	-.015		54.35	1.244	1.352	1.377	1.377	-.087	-.107		
135	41.40	.882	.969	.912	-.099	-.034	-.034		50.20	1.163	1.208	1.231	1.231	-.039	-.058		
	35.72	.678	.755	.711	-.114	-.049	-.049		46.12	1.024	1.063	1.084	1.084	-.038	-.059		
135	25.33	.381	.406	.382	-.065	-.003	-.003		27.43	.384	.435	.443	.443	-.133	-.154		
	42.95	.900	.900	.968	0	-.076	-.076	135	55.95	1.265	1.265	1.432	0	-.132	-.132		
135	32.65	.574	.564	.607	.017	-.057	-.057		34.77	.587	.636	.678	.678	-.083	-.155		
15	45	25.17	.374	.374	.377	0	-.008	15	45	34.95	.657	.657	.685	0	-.043		
	14.82	.169	.135	.136	.201	.195	.195		16.88	.191	.161	.176	.176	.141	.079		
90	48.98	1.210	1.210	1.187	0	.019	.019	90	56.97	1.383	1.383	1.466	0	-.060			
	46.52	1.060	1.119	1.098	-.056	-.036	-.036		52.85	1.170	1.251	1.325	1.325	-.069	-.132		
135	40.45	.828	.894	.878	-.080	-.060	-.060		48.90	1.090	1.118	1.184	1.184	-.025	-.086		
	34.93	.638	.697	.684	-.092	-.072	-.072		42.87	.964	.984	.965	.965	-.021	-.001		
135	24.82	.350	.374	.367	-.069	-.049	-.049		26.87	.379	.402	.426	.426	-.061	-.124		
	45.75	.985	.985	1.070	0	-.086	-.086	135	56.23	1.328	1.328	1.441	0	-.085			
135	35.83	.659	.653	.715	.009	-.085	-.085		37.92	.681	.726	.788	.788	-.066	-.157		
20	45	21.23	.277	.277	.273	0	.014	20	45	31.48	.528	.528	.569	0	-.078		
	11.02	.116	.077	.076	.336	.345	.345		13.07	.142	.099	.107	.107	.303	.246		
90	47.23	1.061	1.064	1.124	0	-.056	-.056	90	54.63	1.246	1.246	1.387	0	-.113			
	44.90	.948	.984	1.039	-.038	-.096	-.096		50.85	1.070	1.126	1.254	1.254	-.050	-.172		
135	39.13	.747	.786	.831	-.052	-.112	-.112		47.15	1.009	1.006	1.121	1.121	-.003	-.111		
	33.85	.576	.613	.647	-.064	-.123	-.123		43.45	.885	.886	.987	.987	-.001	-.115		
135	24.10	.331	.329	.348	.006	-.051	-.051		26.08	.353	.362	.403	.403	-.026	-.142		
	48.65	1.045	1.045	1.176	0	-.125	-.125	135	58.27	1.371	1.371	1.509	0	-.101			
135	38.82	.735	.729	.820	.008	-.116	-.116		40.85	.759	.808	.892	.892	-.065	-.175		
25	45	17.22	.200	.200	.183	0	.085	25	45	27.33	.407	.407	.440	0	-.081		
	7.18	.077	.036	.033	.532	.571	.571		9.20	.097	.049	.053	.053	.495	.454		
90	45.02	.927	.927	1.044	0	-.126	-.126	90	51.87	1.088	1.088	1.291	0	-.187			
	42.85	.840	.857	.965	-.020	-.149	-.149		48.40	.954	.983	1.166	1.166	-.030	-.222		
135	37.45	.677	.685	.771	-.012	-.139	-.139		45.00	.896	.879	1.043	1.043	.018	-.164		
	32.47	.520	.534	.601	-.035	-.155	-.155		41.55	.797	.773	.918	.918	.030	-.152		
135	23.17	.310	.287	.323	-.071	-.042	-.042		25.08	.328	.316	.375	.375	.037	-.143		
	41.47	.810	.807	.915	.004	-.133	-.133	135	60.07	1.384	1.384	1.567	0	-.132			
135	50.92	1.109	1.109	1.257	0	-.130	-.130		43.53	.832	.874	.990	.990	-.050	-.190		

a,c See footnotes at end of table.

TABLE II. - MEASURED AND THEORETICAL VALUES OF PRESSURE COEFFICIENTS FOR  
THREE-DIMENSIONAL AERODYNAMICALLY BLUNT BODIES - Continued

(c) Parabolic-arc bodies;  $\phi = 45^\circ, 90^\circ, 135^\circ$  meridians - Concluded

$\theta_a = 78^\circ$								$\theta_a = 90^\circ$								
$\alpha$ , deg	$\phi$ , deg	$\delta$ , deg	$C_p$ ,meas	$C_p$	$C_p$	$C_p$ ,meas - $C_p$		$C_p$ ,meas	$C_p$	$C_p$	$C_p$	$C_p$ ,meas - $C_p$		$C_p$ ,meas	$C_p$	
						$C_p$ ,meas	(a)					$C_p$ ,meas	(a)			
0	45	40.12	0.806	0.806	0.789	0	.021	0	45	45.88	0.924	0.925	0.937	0	-0.014	
	20.92	.253	.247	.242	.024	.042	.042	90	63.42	1.540	1.519	1.519	1.519	.375	.025	
	58.63	1.397	1.404	1.386	-.005	.013	.008	90	58.63	1.404	1.386	1.386	1.386	0	.001	
	48.45	1.110	1.078	1.064	.029	.041	.041	90	20.88	1.110	.821	.800	.789	1.677	-.017	
	40.13	.821	.800	.789	.026	.038	.038	90	40.13	.821	.800	.789	.789	1.540	1.538	
	40.15	.803	.803	.790	0	.043	.056	90	20.80	.256	.245	.242	.242	.927	-.003	
	40.15	.803	.803	.790	0	.017	.017	90	39.95	.789	.778	.763	.763	.930	-.007	
	20.93	.244	.247	.242	-.012	.006	.006	90	20.80	.234	.238	.240	.240	.377	-.008	
	45	36.50	.668	.668	.672	0	-.006	135	45.85	.889	.889	.889	.889	1.519	1.519	
	17.33	.179	.168	.169	.061	.056	.056	135	20.88	.247	.247	.247	.247	.377	0	
5	45	62.98	1.498	1.498	1.508	0	-.007	5	45	42.25	.788	.788	.788	.788	0	-.043
	58.27	1.362	1.366	1.374	-.003	-.009	90	58.27	73.12	1.650	1.650	1.650	1.650	1.665	.034	
	48.20	1.075	1.049	1.056	.024	.018	90	48.20	1.075	.664	.640	.640	.640	1.513	1.527	
	39.40	.789	.778	.763	.014	-.008	90	39.40	.789	.778	.763	.763	.763	1.287	1.309	
	45.38	.891	.891	.903	0	-.025	90	45.38	.891	.891	.891	.891	.914	.922	-.012	
	24.42	.300	.320	.325	-.066	-.083	90	24.42	.300	.320	.325	.325	.371	.371	-.008	
	45	135	49.27	.999	.999	1.044	0	135	49.27	.999	.999	.999	.999	1.044	0	
	17.47	1.014	1.013	1.032	.027	-.009	135	30.52	.454	.449	.449	.449	.449	.469	-.011	
	39.40	.766	.751	.766	.020	0	135	30.52	.454	.449	.449	.449	.449	.469	-.011	
	20.55	.237	.230	.234	.030	.013	135	33.85	.540	.545	.545	.545	.545	.564	-.009	
10	45	46.78	1.008	1.008	1.009	0	-.001	10	45	38.43	.659	.659	.659	.659	.702	-.066
	17.47	1.014	1.013	1.032	.027	-.009	90	17.47	1.014	.751	.751	.751	.751	.751	.101	
	39.40	.766	.751	.766	.020	0	90	39.40	.766	.751	.751	.751	.751	.751	-.020	
	20.55	.237	.230	.234	.030	.013	90	20.55	.237	.230	.234	.234	.234	.234	-.040	
	45	135	52.38	1.102	1.102	1.102	0	135	46.78	.5238	.5238	.5238	.5238	.5238	1.102	1.102
	17.47	1.017	1.017	1.036	0	-.001	135	33.85	.540	.545	.545	.545	.545	.564	-.009	
	31.07	.472	.507	.506	-.074	-.072	135	37.62	.630	.633	.633	.633	.633	.677	-.005	
	45	59.73	1.357	1.357	1.417	0	-.044	15	45	34.47	.549	.549	.549	.549	0	-.061
	55.57	.924	1.237	1.293	.010	-.035	90	55.57	68.10	1.559	1.559	1.559	1.559	1.565	.198	
	46.28	.950	.950	.953	-.075	-.009	90	46.28	62.68	1.568	1.568	1.568	1.568	1.568	0	
15	45	38.50	.724	.705	.736	.026	-.017	90	38.50	.535	1.209	1.210	1.210	1.210	1.230	-.017
	20.55	.236	.216	.225	.081	.047	90	20.55	.535	43.68	.845	.845	.845	.845	.867	-.026
	45	49.72	1.107	1.107	1.106	0	-.001	135	38.50	.535	26.08	.551	.551	.551	.551	.571
	17.47	1.107	1.107	1.106	0	-.072	135	37.62	.630	.633	.633	.633	.633	.677	-.005	
	31.07	.472	.507	.506	-.074	-.072	135	37.62	.630	.633	.633	.633	.633	.677	-.074	
	45	59.73	1.243	1.243	1.342	0	-.080	20	45	30.42	.555	.555	.555	.555	0	.161
	55.57	1.243	1.243	1.342	0	-.063	90	55.57	64.50	1.555	1.555	1.555	1.555	1.561	.541	
	44.68	.915	.870	.940	.049	-.027	90	44.68	59.80	1.582	1.426	1.426	1.426	1.435	.047	
	37.28	.671	.646	.697	.037	-.039	90	37.28	42.22	.854	.861	.861	.861	.861	-.008	
	19.58	.219	.198	.213	.096	.027	90	19.58	25.32	.355	.358	.358	.358	.358	.039	
20	45	52.85	1.181	1.181	1.207	0	-.022	135	52.85	57.43	1.212	1.212	1.212	1.212	1.224	-.065
	34.17	.545	.596	.599	-.094	-.099	135	39.98	.637	.705	.705	.705	.705	.751	-.179	
	45	20.83	.253	.253	.222	0	.123	25	45	26.27	.444	.444	.444	.444	0	.197
	2.53	.048	.004	.004	.004	.917	.917	90	20.83	.707	.837	.837	.837	.837	.676	.741
	50.70	1.047	1.016	1.138	.030	-.087	90	50.70	.6052	1.451	1.451	1.451	1.451	1.451	0	.050
	42.70	.835	.780	.874	.066	-.047	90	42.70	.5648	1.275	1.331	1.331	1.331	1.263	-.044	.009
	35.75	.614	.579	.649	.055	-.057	90	35.75	.5052	1.140	1.141	1.141	1.141	1.083	0	.050
	18.85	.204	.177	.198	.132	.029	90	18.85	.4038	.794	.804	.804	.804	.763	-.014	.039
	54.37	1.242	1.242	1.255	0	-.010	135	54.37	.2434	.337	.326	.326	.326	.309	.033	.083
	37.08	.644	.683	.691	-.061	-.073	135	42.70	.719	.709	.836	.836	.836	.836	0	-.052

<sup>a,c</sup>See footnotes at end of table.

TABLE II. - MEASURED AND THEORETICAL VALUES OF PRESSURE COEFFICIENTS FOR  
THREE-DIMENSIONAL AERODYNAMICALLY BLUNT BODIES - Continued

(d) Circular-arc bodies;  $\phi = 180^\circ$  meridian

$\theta_a = 56^\circ$												$\theta_a = 66^\circ$											
$\alpha$ , deg	$\delta$ , deg	$C_p$ ,meas	$C_p$	$C_p$	$C_p$ ,meas - $C_p$		$C_p$ ,meas - $C_p$		$\alpha$ , deg	$\delta$ , deg	$C_p$ ,meas	$C_p$	$C_p$	$C_p$ ,meas - $C_p$		$C_p$ ,meas - $C_p$		$\alpha$ , deg	$\delta$ , deg	$C_p$ ,meas	$C_p$		
					(a)	(b)	(a)	(b)						(a)	(b)	(a)	(b)	(a)	(b)				
0	55.48	1.542	1.542	1.503	0	.046			0	65.63	1.818	1.818	1.808	0							0.006		
	54.12	1.480	1.491	1.453	-.007	.018				64.01	1.744	1.770	1.760	-.015							-.009		
	52.69	1.398	1.436	1.400	-.027	.001				62.01	1.613	1.708	1.699	-.059							-.053		
	47.90	1.172	1.250	1.219	-.067	.040				59.86	1.522	1.639	1.629	-.076							-.070		
	42.45	.906	1.035	1.008	-.141	.112				53.73	1.258	1.421	1.416	-.132							-.125		
	36.64	.693	.809	.788	-.166	.136				47.60	1.037	1.195	1.188	-.152							-.145		
	33.21	.581	.681	.664	-.174	.144				40.43	.792	.922	.916	-.163							-.157		
	30.08	.497	.571	.556	-.149	.120				36.07	.616	.760	.755	-.234							-.227		
	21.91	.283	.316	.308	-.116	.088				31.64	.485	.603	.599	-.244							-.236		
	14.77	.148	.148	.144	.004	.029				19.11	.196	.235	.235	-.200							-.193		
5	7.96	.075	.044	.043	.423	.438				10.45	.099	.072	.072	.274							.278		
	60.48	1.686	1.686	1.676	0	.006			5	70.63	1.818	1.818	1.810	0							.005		
	59.12	1.600	1.640	1.650	-.025	.019				69.01	1.804	1.780	1.772	.013							.017		
	57.69	1.522	1.590	1.581	-.015	.039				67.01	1.719	1.731	1.723	-.007							0		
	52.90	1.307	1.416	1.408	-.083	.077				64.86	1.644	1.874	1.866	-.018							-.014		
	47.45	1.056	1.208	1.201	-.144	.138				58.73	1.407	1.492	1.486	-.060							-.055		
	41.64	.853	.983	.977	-.151	.145				52.60	1.199	1.289	1.283	-.075							-.070		
	38.21	.731	.851	.847	-.165	.159				45.43	.954	1.037	1.032	-.087							-.082		
	35.08	.655	.735	.731	-.157	.151				41.07	.769	.882	.878	-.147							-.141		
	26.91	.389	.456	.453	-.173	.166				36.64	.621	.727	.724	-.171							-.166		
10	19.77	.219	.254	.253	-.163	.157				24.11	.276	.341	.339	-.236							-.250		
	12.96	.121	.112	.111	.078	.082				15.45	.156	.145	.144	.069							.073		
	5.00	.044	.017	.017	.616	.618				5.00	.051	.016	.015	.694							.695		
	65.48	1.804	1.804	1.789	0	.008			10	76.62	1.775	1.812	1.782	-.021							-.021		
	64.12	1.717	1.764	1.750	-.027	.019				74.01	1.818	1.785	1.785	0							.018		
	62.69	1.655	1.721	1.706	-.041	.032				72.01	1.789	1.780	1.747	.005							.024		
	57.90	1.464	1.565	1.551	-.069	.059				69.86	1.735	1.734	1.702	.001							.019		
	52.45	1.231	1.370	1.359	-.113	.104				63.73	1.539	1.582	1.553	-.028							-.009		
	46.64	1.034	1.152	1.142	-.114	.105				57.60	1.344	1.403	1.377	-.043							-.024		
	43.21	.913	1.021	1.014	-.119	.110				50.43	1.108	1.169	1.148	-.055							-.035		
15	40.08	.812	.903	.896	-.112	.103				46.07	.917	1.020	1.002	-.115							-.093		
	31.91	.524	.609	.604	-.162	.152				41.64	.768	.869	.855	-.131							-.110		
	24.77	.317	.382	.379	-.205	.196				29.11	.381	.466	.457	-.221							-.199		
	17.96	.192	.207	.206	-.080	.072				20.45	.208	.240	.235	-.153							-.132		
	10.00	.086	.066	.065	.236	.242				10.00	.090	.059	.058	.359							.351		
	70.48	1.818	1.818	1.807	0	.006			15	80.63	1.700	1.814	1.796	-.067							-.067		
	69.12	1.779	1.787	1.776	-.005	.002				79.01	1.805	1.770	1.766	.005							.005		
	67.69	1.717	1.752	1.741	-.020	.014				77.01	1.821	1.816	1.770	.028							.028		
	62.90	1.554	1.622	1.612	-.044	.037				74.86	1.794	1.782	1.737	.007							.032		
	57.45	1.341	1.454	1.445	-.085	.078				68.73	1.657	1.661	1.619	-.002							.023		
20	51.64	1.161	1.259	1.251	-.084	.077				62.60	1.497	1.507	1.469	-.007							.018		
	48.21	1.040	1.138	1.131	-.094	.087				55.43	1.275	1.297	1.264	-.017							.009		
	45.08	.940	1.026	1.020	-.091	.084				51.07	1.092	1.158	1.128	-.060							-.033		
	36.91	.645	.738	.734	-.144	.137				46.64	.940	1.011	.985	-.076							-.048		
	29.77	.403	.504	.501	-.252	.244				34.11	.515	.602	.586	-.168							-.138		
	22.96	.257	.311	.309	-.212	.204				25.45	.305	.353	.344	-.159							-.130		
	15.00	.134	.137	.136	-.021	.014				15.00	.145	.128	.125	.140							.140		
	75.48	1.814	1.810	1.810	0	.002			20	85.63	1.572	1.816	1.807	-.156							-.156		
	74.12	1.819	1.806	1.786	-.007	.018				84.01	1.750	1.792	1.792	-.032							-.032		
	72.69	1.780	1.779	1.760	-.001	.011				82.01	1.808	1.729	1.723	.009							.009		
25	67.90	1.656	1.676	1.658	-.012	.001				79.86	1.809	1.812	1.770	-.021							.021		
	62.45	1.473	1.535	1.518	-.042	.031				75.73	1.729	1.684	1.684	.026							.026		
	56.64	1.299	1.361	1.347	-.048	.036				67.60	1.593	1.598	1.562	-.003							.020		
	53.21	1.252	1.239	1.239	0	.001				60.43	1.393	1.415	1.382	-.015							.008		
	50.08	1.070	1.148	1.136	-.073	.062				56.07	1.236	1.288	1.258	-.042							-.017		
	41.91	.795	.871	.861	-.095	.083				51.64	1.094	1.150	1.123	-.051							-.027		
	34.77	.528	.635	.628	-.202	.189				39.11	.651	.744	.727	-.144							-.117		
	27.96	.355	.429	.425	-.210	.197				30.45	.409	.480	.469	-.174							-.147		
	20.00	.190	.228	.226	-.204	.191				20.00	.195	.219	.214	-.121							-.095		
	80.48	1.741	1.812	1.812	0	.041			25	90.63	1.421	1.817	1.817	-.279							-.279		
25	79.12	1.812	1.824	1.797	-.007	.008				89.01	1.650	1.817	1.817	-.101							-.101		
	77.69	1.798	1.805	1.778	-.004	.011				87.01	1.766	1.812	1.812	-.027							-.027		
	72.90	1.732	1.728	1.702	-.002	.017				84.86	1.806	1.803	1.803	.002							.002		
	67.45	1.568	1.613	1.589	-.016	.001				82.43	1.806	1.810	1.786	-.0									

TABLE II. - MEASURED AND THEORETICAL VALUES OF PRESSURE COEFFICIENTS FOR  
THREE-DIMENSIONAL AERODYNAMICALLY BLUNT BODIES - Continued

(a) Circular-arc bodies;  $\phi = 180^\circ$  meridian - Concluded

$\theta_a = 70^\circ$										$\theta_a = 90^\circ$									
$\alpha$ , deg	$\delta$ , deg	$C_p$ ,meas	$C_p$ (a)	$C_p$ (b)	$C_p$ ,meas - $C_p$		$C_p$ ,meas - $C_p$		$\alpha$ , deg	$\delta$ , deg	$C_p$ ,meas	$C_p$ (a)	$C_p$ (b)	$C_p$ ,meas - $C_p$		$C_p$ ,meas - $C_p$		$C_p$ ,meas - $C_p$	
					$C_p$ ,meas	(a)	$C_p$ ,meas	(b)						$C_p$ ,meas	(a)	$C_p$ ,meas	(b)		
0	77.25	1.818	1.818	1.808	0		0.006		0	89.71	1.818	1.818	1.817	0		0		.002	
	75.33	1.797	1.789	1.778	.005		.010			87.58	1.818	1.814	1.814						.002
	73.31	1.763	1.753	1.743	.005		.011			84.44	1.800	1.800	1.800						0
	70.68	1.705	1.702	1.692	.002		.008			80.67	1.770	1.769	1.769						0
	67.27	1.610	1.626	1.617	-.010		-.004			76.79	1.720	1.722	1.722						-.001
	60.81	1.453	1.456	1.448	-.002		.003			68.91	1.559	1.582	1.581						-.015
	51.63	1.153	1.175	1.168	-.019		-.013			59.65	1.312	1.353	1.353						-.032
	42.98	.813	.888	.883	-.092		-.086			48.55	.912	1.021	1.021						-.062
	36.42	.662	.674	.670	-.017		-.011			44.09	.813	.880	.880						-.082
	31.26	.479	.515	.511	-.074		-.068			35.92	.582	.625	.625						-.074
	9.53	.115	.052	.052	.542		.545			14.31	.147	.111	.111						.244
5	82.25	1.814	1.812	1.812			.001		5	94.71	1.795	1.805	1.805						-.012
	80.33	1.814	1.808	1.793	-.003		.011			92.58	1.812	1.814	1.814						-.001
	78.51	1.765	1.784	1.770	-.011		-.002			89.45	1.812	1.818	1.818						-.003
	75.68	1.771	1.747	1.733	.014		.022			85.67	1.811	1.807	1.807						.002
	72.27	1.705	1.688	1.674	.010		.018			81.79	1.780	1.781	1.781						0
	65.81	1.561	1.548	1.536	.008		.016			73.91	1.660	1.678	1.678						-.011
	56.63	1.282	1.298	1.287	-.012		-.004			64.65	1.450	1.485	1.485						-.024
	47.98	.971	1.027	1.019	-.058		-.049			53.55	1.120	1.176	1.176						-.050
	41.42	.811	.814	.808	-.004		.004			49.09	.976	1.038	1.038						-.063
	36.26	.608	.651	.646	-.070		-.062			40.92	.723	.780	.780						-.078
	14.53	.167	.117	.116	.300		.305			19.31	.212	.199	.199						.062
	5.00	.058	.014	.014	.758		.760			5.00	.063	.014	.014						.781
10	87.25	1.761	1.816		-.031				10	99.71	1.756	1.766	1.766						-.007
	85.33	1.799	1.808		-.005					97.58	1.784	1.787	1.787						-.001
	83.31	1.765	1.795		.017					94.44	1.809	1.807	1.807						.001
	80.68	1.804	1.796	1.772	.005		.018			90.67	1.820	1.818	1.818						.001
	77.27	1.764	1.755	1.732	.005		.018			86.79	1.818	1.812	1.812						.003
	70.81	1.655	1.645	1.623	.006		.019			78.91	1.742	1.751	1.751						-.005
	61.63	1.414	1.428	1.409	-.010		.004			69.65	1.580	1.598	1.598						-.011
	52.98	1.138	1.176	1.160	-.033		-.019			58.55	1.274	1.323	1.323						-.039
	46.42	.971	.968	.955	.004		.017			54.09	1.138	1.193	1.193						-.048
	41.26	.746	.802	.791	.076		-.062			45.92	.885	.938	.938						-.060
	19.25	.235	.206	.203	.124		.135			24.31	.296	.308	.308						-.041
	10.00	.096	.056	.055	.419		.426			10.00	.102	.055	.055						.463
15	92.25	1.677	1.816		-.083				15	104.71	1.669	1.702	1.702						-.020
	90.33	1.756	1.818		-.035					102.58	1.714	1.733	1.733						-.011
	88.31	1.798	1.817		-.011					99.45	1.753	1.770	1.770						-.010
	85.68	1.812	1.808	1.808	.002		.002			95.67	1.792	1.801	1.801						-.005
	82.27	1.808	1.786		.004		.012			91.79	1.813	1.817	1.817						-.002
	75.81	1.740	1.723	1.709	-.010		.018			87.77	1.811	1.816	1.816						-.003
	66.63	1.553	1.545	1.532	.005		.013			78.58	1.745	1.749	1.748						-.002
	57.98	1.313	1.318	1.307	-.004		.004			69.99	1.590	1.607	1.606						-.010
	51.42	1.135	1.120	1.111	.004		.021			59.09	1.300	1.342	1.339						-.032
	46.26	.911	.957	.949	-.005		.042			50.92	1.057	1.097	1.096						-.037
	24.25	.330	.320	.317	.032		.040			29.31	.406	.436	.436						-.076
	15.00	.151	.123	.122	.185		.192			15.00	.140	.122	.122						.128
20	97.25	1.571	1.789		-.139				20	109.71	1.568	1.611	1.611						-.028
	95.33	1.680	1.802		-.073					107.58	1.623	1.652	1.652						-.018
	93.31	1.807	1.812		-.003					104.45	1.683	1.705	1.705						-.013
	90.68	1.800	1.818		-.010					100.67	1.745	1.755	1.755						-.006
	87.27	1.813	1.814		-.001					96.79	1.786	1.792	1.792						-.004
	83.93	1.812	1.806	1.798	.003		.008			88.91	1.806	1.817	1.817						-.006
	75.90	1.733	1.718	1.710	.009		.013			79.65	1.747	1.759	1.759						-.007
	68.12	1.568	1.573	1.566	-.003		.002			68.55	1.555	1.575	1.575						-.013
	56.42	1.273	1.268	1.262	.004		.009			64.09	1.439	1.470	1.470						-.022
	51.26	1.064	1.111	1.106	-.044		-.040			55.92	1.209	1.247	1.247						-.032
	29.53	.440	.444	.442	-.009		-.005			34.31	.522	.578	.578						-.107
	20.00	.219	.214	.213	.026		.030			20.00	.198	.213	.213						-.078
25	102.25	1.435	1.736		-.210				25	114.71	1.454	1.501	1.501						-.032
	100.33	1.578	1.760		-.115					112.58	1.525	1.550	1.550						-.016
	98.31	1.798	1.780		.010					109.45	1.595	1.617	1.617						-.014
	95.68	1.749	1.800		-.029					105.67	1.681	1.686	1.686						-.003
	92.27	1.795	1.815		-.011					101.79	1.744	1.745	1.745						.001
	88.93	1.813	1.818		-.002					93.91	1.812	1.810	1.810						.001
	85.81	1.807	1.811	1.808	-.002		-.001			88.58	1.819	1.817	1.817						.001
	76.63	1.729	1.724	1.721	.003		.004			79.99	1.763	1.764	1.764						0
	67.98	1.560	1.565	1.563	-.003		-.002			69.09	1.569	1.587	1.587						-.011
	56.26	1.198	1.259	1.257	-.051		-.050			60.92	1.356	1.389	1.389						-.024
	34.53	.558	.585	.584	-.048		-.047			39.31	.667	.750	.750						-.095
	25.00	.301	.325	.325	-.081		-.080			25.00	.294	.325	.325						-.101

a,b See footnotes at end of table.

TABLE II. - MEASURED AND THEORETICAL VALUES OF PRESSURE COEFFICIENTS FOR  
THREE-DIMENSIONAL AERODYNAMICALLY BLUNT BODIES - Continued

(e) Circular-arc bodies;  $\phi = 0^\circ$  meridian

$\theta_B = 56^\circ$												$\theta_B = 66^\circ$											
$\alpha$ , deg	$\delta$ , deg	$C_p$ ,meas	$C_p$	$C_p$	$C_p$ ,meas - $C_p$		$C_p$ ,meas - $C_p$		$\alpha$ , deg	$\delta$ , deg	$C_p$ ,meas	$C_p$	$C_p$	$C_p$ ,meas - $C_p$		$C_p$ ,meas - $C_p$		$C_p$ ,meas	$C_p$	$C_p$			
					$C_p$ ,meas	$C_p$	$C_p$ ,meas	$C_p$						$C_p$ ,meas	$C_p$	$C_p$ ,meas	$C_p$	$C_p$ ,meas	$C_p$				
0	54.31	1.499	1.499	1.460	0	.026	0	.010	0	63.91	1.654	1.654	1.757	0	.007	.007	.007	.007	.007	.007	.007	.007	.007
	52.93	1.423	1.447	1.409	-.017	-.028	-.028	-.028	61.76	1.591	1.591	1.691	1.757	0	.007	.007	.007	.007	.007	.007	.007	.007	.007
	51.22	1.309	1.381	1.345	-.055	-.054	-.054	-.054	60.33	1.537	1.537	1.548	1.645	0	.007	.007	.007	.007	.007	.007	.007	.007	.007
	49.03	1.197	1.296	1.262	-.082	-.054	-.054	-.054	57.56	1.428	1.428	1.460	1.552	0	.023	.023	.023	.023	.023	.023	.023	.023	.023
	46.81	1.126	1.208	1.177	-.073	-.045	-.045	-.045	54.94	1.303	1.303	1.374	1.459	0	.054	.054	.054	.054	.054	.054	.054	.054	.054
	44.53	.983	1.118	1.089	-.137	-.108	-.108	-.108	49.60	1.111	1.111	1.189	1.263	0	.120	.120	.120	.120	.120	.120	.120	.120	.120
	42.42	.893	1.055	1.008	-.160	-.129	-.129	-.129	43.85	.926	.926	.984	1.046	0	.129	.129	.129	.129	.129	.129	.129	.129	.129
	39.56	.782	.922	.898	-.179	-.148	-.148	-.148	36.36	.644	.644	.721	.766	0	.189	.189	.189	.189	.189	.189	.189	.189	.189
	36.51	.679	.804	.784	-.185	-.155	-.155	-.155	31.82	.502	.502	.570	.605	0	.205	.205	.205	.205	.205	.205	.205	.205	.205
	30.05	.478	.570	.555	-.193	-.161	-.161	-.161	19.34	.213	.213	.225	.239	0	.122	.122	.122	.122	.122	.122	.122	.122	.122
	21.78	.270	.313	.305	-.157	-.130	-.130	-.130	10.71	.100	.100	.071	.075	0	.250	.250	.250	.250	.250	.250	.250	.250	.250
	11.84	.115	.096	.095	-.177	-.177	-.177	-.177	2.14	.037	.037	.003	.003	0	.919	.919	.919	.919	.919	.919	.919	.919	.919
	1.35	.035	.001	.001	.964	.971																	
5	49.31	1.294	1.294	1.273	0	.016	.009	.009	58.91	1.512	1.512	1.598	1.654	0	.057	.057	.057	.057	.057	.057	.057	.057	.057
	47.93	1.231	1.241	1.220	-.007	-.033	-.033	-.033	56.76	1.453	1.453	1.524	1.645	0	.049	.049	.049	.049	.049	.049	.049	.049	.049
	46.22	1.117	1.174	1.154	-.051	-.051	-.051	-.051	55.33	1.384	1.384	1.474	1.552	0	.065	.065	.065	.065	.065	.065	.065	.065	.065
	44.03	.983	1.087	1.069	-.106	-.087	-.087	-.087	52.56	1.265	1.265	1.374	1.474	0	.086	.086	.086	.086	.086	.086	.086	.086	.086
	41.81	.940	1.001	.984	-.064	-.047	-.047	-.047	49.94	1.139	1.139	1.208	1.276	0	.120	.120	.120	.120	.120	.120	.120	.120	.120
	37.45	.706	.832	.818	-.177	-.159	-.159	-.159	44.60	.934	.934	1.016	1.074	0	.150	.150	.150	.150	.150	.150	.150	.150	.150
	31.51	.513	.615	.616	-.200	-.201	-.201	-.201	38.85	.749	.749	.811	.857	0	.184	.184	.184	.184	.184	.184	.184	.184	.184
	25.05	.344	.404	.397	-.173	-.154	-.154	-.154	31.36	.498	.498	.558	.590	0	.184	.184	.184	.184	.184	.184	.184	.184	.184
	16.78	.182	.188	.185	-.029	-.016	-.016	-.016	26.82	.374	.374	.420	.443	0	.184	.184	.184	.184	.184	.184	.184	.184	.184
	6.84	.062	.032	.031	.487	.500			14.34	.145	.145	.182	.213	0	.076	.076	.076	.076	.076	.076	.076	.076	.076
	10	53.91	1.133	1.133	1.080	0	.047	.047	5.71	.058	.058	.020	.022	0	.621	.621	.621	.621	.621	.621	.621	.621	.621
10	42.93	1.075	1.077	1.027	-.002	-.045	-.045	-.045	53.91	1.349	1.349	1.423	1.512	0	.055	.055	.055	.055	.055	.055	.055	.055	.055
	41.22	.969	1.008	.961	-.041	-.008	-.008	-.008	50.33	1.215	1.215	1.291	1.344	0	.048	.048	.048	.048	.048	.048	.048	.048	.048
	39.03	.827	.921	.878	-.112	-.062	-.062	-.062	47.56	1.093	1.093	1.125	1.187	0	.063	.063	.063	.063	.063	.063	.063	.063	.063
	36.81	.775	.834	.795	-.076	-.026	-.026	-.026	42.22	.869	.869	.933	.984	0	.152	.152	.152	.152	.152	.152	.152	.152	.152
	32.45	.564	.668	.637	-.184	-.129	-.129	-.129	36.75	.688	.688	.739	.780	0	.134	.134	.134	.134	.134	.134	.134	.134	.134
	26.51	.390	.463	.441	-.187	-.131	-.131	-.131	30.57	.512	.512	.534	.563	0	.100	.100	.100	.100	.100	.100	.100	.100	.100
	20.05	.248	.273	.260	-.102	-.048	-.048	-.048	21.82	.280	.280	.301	.315	0	.075	.075	.075	.075	.075	.075	.075	.075	.075
	11.78	.120	.097	.092	.191	.233	.233	.233	9.34	.094	.094	.054	.057	0	.394	.394	.394	.394	.394	.394	.394	.394	.394
	1.84	.029	.002	.002	.917	.931			15	48.91	1.178	1.178	1.258	1.357	0	.051	.051	.051	.051	.051	.051	.051	.051
15	39.31	.959	.959	.889	0	.072	.072	.072	46.76	1.106	1.106	1.156	1.258	0	.045	.045	.045	.045	.045	.045	.045	.045	.045
	37.93	.930	.904	.836	-.028	-.048	-.048	-.048	45.33	1.043	1.043	1.102	1.258	0	.056	.056	.056	.056	.056	.056	.056	.056	.056
	34.03	.661	.757	.693	-.115	-.032	-.032	-.032	42.56	.918	.918	.949	.997	0	.086	.086	.086	.086	.086	.086	.086	.086	.086
	31.81	.596	.664	.615	-.115	-.032	-.032	-.032	37.22	.714	.714	.759	.797	0	.116	.116	.116	.116	.116	.116	.116	.116	.116
	27.45	.425	.525	.470	-.235	-.106	-.106	-.106	31.75	.545	.545	.574	.603	0	.106	.106	.106	.106	.106	.106	.106	.106	.106
	21.51	.278	.321	.298	-.154	-.072	-.072	-.072	25.57	.388	.388	.406	.406	0	.046	.046	.046	.046	.046	.046	.046	.046	.046
	15.05	.162	.161	.149	.007	.080	.080	.080	16.82	.192	.192	.174	.182	0	.052	.052	.052	.052	.052	.052	.052	.052	.052
	6.78	.067	.033	.031	.504	.537			4.34	.056	.056	.012	.012	0	.052	.052	.052	.052	.052	.052	.052	.052	.052
20	34.31	.781	.782	.703	0	.100	.100	.100	20	43.91	.988	.988	1.048	1.357	0	.060	.060	.060	.060	.060	.060	.060	.060
	31.22	.641	.661	.595	-.031	-.072	-.072	-.072	41.76	.913	.913	.967	.997	0	.059	.059	.059	.059	.059	.059	.059	.059	.059
	26.81	.451	.501	.450	-.109	-.002	-.002	-.002	40.33	.858	.858	.860	.913	0	.064	.064	.064	.064	.064	.064	.064	.064	.064
	19.56	.248	.276	.248	-.111	-.011	-.011	-.011	37.56	.740	.740	.763	.810	0	.095	.095	.095	.095	.095	.095	.095	.095	.095
	10.05	.106	.075	.067	.293	.368	.368	.368	32.22	.555	.555	.584	.619	0	.088	.088	.088	.088	.088	.088	.088	.088	.088
	1.78	.036	.002	.002	.954	.944	.944	.944	26.75	.413	.413	.441	.441	0	.068	.068	.068	.068	.068	.068	.068	.068	.068
	29.31	.620	.620	.531	0	.144	.144	.144	11.82	.134	.134	.086	.091	0	.321	.321	.321	.321	.321	.321	.321	.321	.321
	27.93	.591	.568	.486	.040	.178	.178	.178	25	38.91	.801	.801	.860	1.048	0	.074	.074	.074	.074	.074	.074	.074	.074
	24.03	.390	.429	.367	-.099	.059	.059	.059	36.76	.724	.724	.780	.860	0	.077	.077	.077	.077	.077	.077	.077	.077	.077
	19.53	.267	.289	.247	-.081	.075	.075	.075	35.33	.681													

TABLE II.- MEASURED AND THEORETICAL VALUES OF PRESSURE COEFFICIENTS FOR  
THREE-DIMENSIONAL AERODYNAMICALLY BLUNT BODIES - Continued

(e) Circular-arc bodies;  $\phi = 0^\circ$  meridian - Concluded

$\theta_a = 78^\circ$												$\theta_a = 90^\circ$						
$\alpha$ , deg	$\delta$ , deg	$C_p, \text{meas}$	$C_p$	$C_p$	$C_p, \text{meas} - C_p$	$C_p, \text{meas} - C_p$	$\alpha$ , deg	$\delta$ , deg	$C_p, \text{meas}$	$C_p$	$C_p$	$C_p, \text{meas} - C_p$	$C_p, \text{meas} - C_p$	$C_p, \text{meas}$	$C_p$	$C_p$	$C_p, \text{meas} - C_p$	$C_p, \text{meas} - C_p$
		(a)	(c)	(a)	(c)	(a)			(a)	(c)	(a)	(c)	(a)	(c)	(a)	(c)	(a)	(c)
0	75.22	1.798	1.798	1.776	0	0.012	0	87.32	1.817	1.817	1.813	0	0	0	0.002	0.002	0.002	
	73.04	1.748	1.760	1.738	-.006	.006		84.65	1.804	1.805	1.801	-.001	0	0	.001	.001	.001	
	70.75	1.693	1.714	1.694	-.013	-.002		81.78	1.779	1.784	1.780	-.003	0	0	0	0	0	
	67.46	1.613	1.641	1.621	-.017	-.005		78.83	1.751	1.753	1.749	-.001	.001	.001	.001	.001	.001	
	64.19	1.522	1.559	1.540	-.024	-.012		74.69	1.682	1.694	1.690	-.007	-.005	0	0	0	0	
	57.23	1.365	1.360	1.344	-.004	.015		71.15	1.613	1.631	1.627	-.011	-.009	0	0	0	0	
	49.93	1.085	1.126	1.113	-.038	-.026		62.29	1.385	1.427	1.424	-.031	-.029	0	0	0	0	
	43.15	.833	.912	.889	-.085	-.067		55.42	1.128	1.174	1.172	-.041	-.039	0	0	0	0	
	37.05	.680	.698	.690	-.027	-.014		44.05	.829	.880	.878	-.062	-.060	0	0	0	0	
	31.85	.502	.536	.529	-.067	-.054		35.80	.595	.623	.622	-.048	-.046	0	0	0	0	
	9.90	.114	.057	.056	.501	.509		14.15	.157	.109	.109	.308	.309	0	0	0	0	
	2.26	.052	.003	.003	.942	.942		2.47	.052	.003	.003	.936	.936	0	0	0	0	
5	70.22	1.718	1.718	1.682	0	.021	5	82.32	1.775	1.775	1.786	0	0	0	-.006	0	0	
	68.04	1.639	1.668	1.634	-.018	.003		79.65	1.745	1.749	1.759	-.003	0	0	-.008	0	0	
	65.75	1.564	1.606	1.580	-.027	-.010		76.78	1.699	1.713	1.723	-.008	-.014	0	0	0	0	
	62.46	1.468	1.525	1.494	-.039	-.018		73.83	1.653	1.667	1.677	-.008	-.014	0	0	0	0	
	59.19	1.359	1.431	1.401	-.053	-.031		69.69	1.566	1.590	1.599	-.015	-.021	0	0	0	0	
	52.23	1.208	1.212	1.196	-.003	.010		66.15	1.484	1.512	1.521	-.019	-.025	0	0	0	0	
	44.93	.925	.967	.948	-.046	-.025		57.29	1.229	1.280	1.287	-.042	-.047	0	0	0	0	
	38.15	.673	.752	.725	-.117	-.077		48.42	.962	1.011	1.017	-.051	-.056	0	0	0	0	
	32.05	.533	.546	.535	-.024	-.004		39.05	.671	.717	.721	-.070	-.076	0	0	0	0	
	26.85	.380	.396	.388	-.042	-.021		30.80	.462	.474	.477	-.026	-.032	0	0	0	0	
	4.90	.070	.014	.014	.799	.800		9.15	.108	.046	.046	.578	.576	0	0	0	0	
10	65.22	1.594	1.594	1.566	0	.018	10	77.32	1.717	1.717	1.731	0	0	0	-.008	0	0	
	63.04	1.494	1.536	1.502	-.028	-.005		74.65	1.667	1.677	1.691	-.006	-.014	0	0	0	0	
	60.75	1.409	1.460	1.446	-.037	-.026		71.78	1.601	1.627	1.640	-.016	-.024	0	0	0	0	
	57.46	1.305	1.374	1.350	-.055	-.034		68.83	1.545	1.568	1.581	-.015	-.024	0	0	0	0	
	54.19	1.185	1.272	1.249	-.073	-.054		64.68	1.459	1.474	1.486	-.024	-.033	0	0	0	0	
	47.23	1.040	1.042	1.024	-.001	.015		61.15	1.344	1.385	1.396	-.030	-.039	0	0	0	0	
	39.93	.777	.797	.783	-.025	-.008		52.29	1.078	1.129	1.138	-.047	-.056	0	0	0	0	
	33.15	.545	.589	.568	-.082	-.042		43.42	.811	.842	.849	-.039	-.047	0	0	0	0	
	27.05	.412	.400	.393	-.029	-.047		34.05	.545	.565	.570	-.205	-.207	0	0	0	0	
	21.85	.280	.267	.263	-.044	-.061		25.80	.354	.342	.344	-.055	-.057	0	0	0	0	
	16.85	.206	.164	.160	.204	.223		4.15	.069	.009	.010	.863	.861	0	0	0	0	
15	60.22	1.472	1.472	1.431	0	.028	15	72.32	1.616	1.616	1.652	0	0	0	-.022	0	0	
	58.04	1.354	1.407	1.368	-.039	-.010		69.65	1.554	1.564	1.599	-.007	-.029	0	0	0	0	
	55.75	1.266	1.319	1.298	-.041	-.029		66.78	1.479	1.503	1.536	-.016	-.036	0	0	0	0	
	52.46	1.154	1.229	1.195	-.064	-.036		63.83	1.417	1.433	1.465	-.012	-.034	0	0	0	0	
	49.19	1.028	1.119	1.088	-.089	-.058		59.69	1.302	1.326	1.356	-.019	-.042	0	0	0	0	
	42.23	.881	.883	.858	-.002	.026		56.15	1.204	1.227	1.255	-.019	-.042	0	0	0	0	
	34.93	.644	.641	.623	.005	.033		47.29	.932	.961	.982	-.031	-.054	0	0	0	0	
	31.58	.516	.536	.521	-.039	-.010		38.42	.673	.687	.702	-.021	-.043	0	0	0	0	
	22.05	.316	.275	.268	.127	.152		29.05	.425	.420	.429	-.014	-.008	0	0	0	0	
	16.85	.206	.164	.160	.204	.223		20.80	.270	.224	.229	.137	.150	0	0	0	0	
20	55.22	1.314	1.314	1.282	0	.024	20	67.32	1.506	1.506	1.548	0	0	0	-.028	0	0	
	53.04	1.190	1.243	1.213	-.044	-.019		64.65	1.451	1.444	1.485	-.009	-.038	0	0	0	0	
	50.75	1.107	1.148	1.139	-.037	-.029		61.78	1.347	1.373	1.411	-.019	-.047	0	0	0	0	
	47.46	.987	1.057	1.032	-.071	-.046		58.83	1.277	1.298	1.331	-.014	-.042	0	0	0	0	
	44.19	.869	.946	.923	-.089	-.062		54.69	1.157	1.177	1.210	-.017	-.046	0	0	0	0	
	37.23	.713	.713	.696	0	.024		51.15	1.054	1.072	1.103	-.018	-.047	0	0	0	0	
	29.93	.508	.485	.473	.045	.069		42.29	.774	.800	.823	-.034	-.064	0	0	0	0	
	23.15	.326	.310	.294	.050	.098		33.42	.534	.556	.551	-.005	-.055	0	0	0	0	
	17.05	.252	.167	.163	.277	.297		24.05	.316	.294	.302	.069	.043	0	0	0	0	
	11.85	.145	.082	.080	.435	.448		15.80	.184	.131	.135	.286	.266	0	0	0	0	
25	50.22	1.131	1.131	1.122	0	.008	25	62.32	1.388	1.388	1.427	0	0	0	-.028	0	0	
	48.04	.998	1.059	1.050	-.061	-.052		59.65	1.317	1.354	1.354	-.010	-.038	0	0	0	0	
	45.75	.932	.960	.975	-.030	-.046		56.78	1.238	1.273	1.273	-.023	-.023	0	0	0	0	
	42.46	.804	.873	.866	-.085	-.077		53.83	1.136	1.153	1.185	-.038	-.043	0	0	0	0	
	35.87	.616	.657	.652	-.067	-.058		49.69	1.014	1.029	1.058	-.015	-.043	0	0	0	0	
	28.72	.485	.442	.439	-.089	-.095		46.15	.900	.920	.946	-.022	-.051	0	0	0	0	
	21.58	.298	.259	.257	.131	.138		37.29	.658	.649	.667	-.018	-.047	0	0	0	0	
	12.05	.167	.083	.083	.499	.503		28.42	.420	.401	.412	.047	.020	0	0	0	0	
								19.05	.235	.188	.194	.199	.177	0	0	0	0	

<sup>a,c</sup>See footnotes at end of table.

TABLE II. - MEASURED AND THEORETICAL VALUES OF PRESSURE COEFFICIENTS FOR  
THREE-DIMENSIONAL AERODYNAMICALLY BLUNT BODIES - Continued

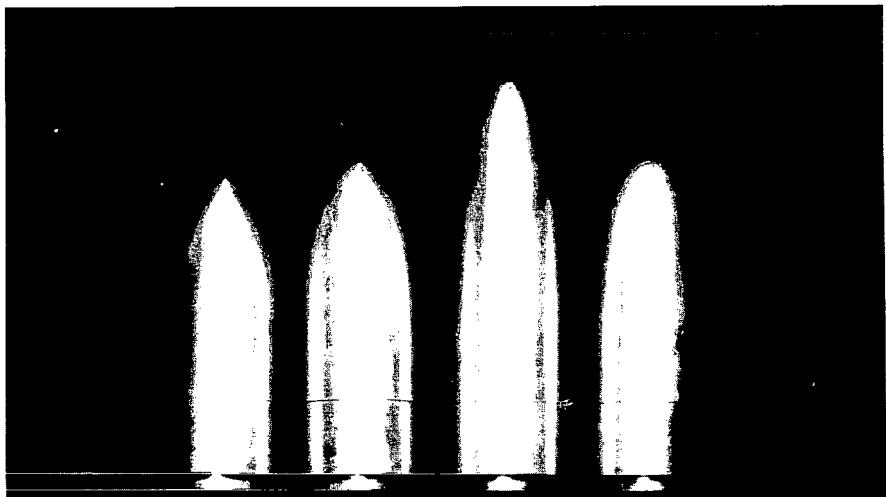
(f) Circular-arc bodies;  $\phi = 45^\circ, 90^\circ, 135^\circ$  meridians

$\theta_a = 56^\circ$												$\theta_a = 66^\circ$																		
$\alpha$ , deg	$\phi$ , deg	$\delta$ , deg	$C_p, \text{meas}$	$C_p$	$C_p$	$C_p, \text{meas} - C_p$	$C_p, \text{meas} - C_p$	$C_p, \text{meas}$	$C_p$	$C_p$	$C_p, \text{meas} - C_p$	$C_p, \text{meas}$	$C_p$	$C_p$	$C_p, \text{meas} - C_p$	$C_p, \text{meas} - C_p$	$C_p, \text{meas}$	$C_p$	$C_p$	$C_p, \text{meas} - C_p$	$C_p, \text{meas} - C_p$	$C_p, \text{meas}$								
(a)	(c)	(a)	(c)	(a)	(c)	(a)	(c)	(a)	(c)	(a)	(c)	(a)	(c)	(a)	(c)	(a)	(c)	(a)	(c)	(a)	(c)	(a)	(c)							
0	45	47.99	1.193	1.193	1.222	0	-.024	0	51.71	1.190	1.190	1.342	0	0	-.128	0	-.116	0	.011	0	.014	0	-.016							
	90	39.65	.799	.880	.901	-.001	-.127	.90	41.49	.857	.848	.956	.011	0	0	0	0	0	0	0	0	0	0	0						
	52.77	1.453	1.491	1.403	1.451	0	.059	.90	63.83	1.731	1.731	1.755	.011	0	0	0	0	0	0	0	0	0	0	0						
	50.17	1.318	1.387	1.305	1.352	-.052	.035	.90	61.95	1.622	1.674	1.697	-.032	0	0	0	0	0	0	0	0	0	0	0						
	47.68	1.216	1.287	1.210	1.258	-.058	.010	.90	57.33	1.421	1.523	1.544	-.072	0	0	0	0	0	0	0	0	0	0	0						
	39.55	.829	.954	.897	.954	-.151	.004	.90	53.87	1.277	1.402	1.421	-.098	0	0	0	0	0	0	0	0	0	0	0						
	135	48.02	1.203	1.203	1.223	0	-.016	.90	43.98	.955	1.036	1.051	-.108	0	0	0	0	0	0	0	0	0	0	0						
	39.66	.825	.887	.902	.887	-.075	-.093	.90	51.55	1.195	1.195	1.336	0	0	0	0	0	0	0	0	0	0	0	0						
									41.45	.837	.853	.955	-.019	0	0	0	0	0	0	0	0	0	0	0	0					
5	45	44.35	1.019	1.019	1.082	0	-.062	5	48.05	1.055	1.055	1.205	0	0	0	0	0	0	0	0	0	0	0	0						
	90	36.03	.655	.722	.767	-.102	-.171	90	63.40	1.696	1.696	1.742	-.002	0	0	0	0	0	0	0	0	0	0	0	0					
	53.77	1.471	1.471	1.440	1.440	0	.021	90	61.55	1.596	1.640	1.684	-.027	0	0	0	0	0	0	0	0	0	0	0	0					
	52.47	1.387	1.422	1.392	1.392	-.025	-.004	90	56.98	1.397	1.492	1.532	-.068	0	0	0	0	0	0	0	0	0	0	0	0					
	49.90	1.264	1.323	1.295	1.295	-.047	-.025	90	53.57	1.255	1.373	1.410	-.094	0	0	0	0	0	0	0	0	0	0	0	0					
	47.45	1.164	1.227	1.201	1.201	-.054	-.032	90	43.77	.914	1.015	1.042	-.111	0	0	0	0	0	0	0	0	0	0	0	0					
	39.37	.788	.910	.890	.890	-.155	-.129	90	54.95	1.292	1.292	1.459	0	0	0	0	0	0	0	0	0	0	0	0	0					
	135	51.42	1.304	1.304	1.352	0	-.037	135	44.88	.939	.960	1.085	-.022	0	0	0	0	0	0	0	0	0	0	0	0	0				
	43.10	.914	.996	1.033	1.033	-.090	-.130	135	54.95	1.292	1.292	1.459	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
10	45	40.52	.882	.882	.934	0	-.058	10	45	44.18	.915	.915	1.058	0	0	0	0	0	0	0	0	0	0	0	0	0				
	90	32.27	.542	.596	.631	-.100	-.164	90	34.08	.594	.592	.684	.003	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
	52.88	1.415	1.415	1.407	1.407	0	.006	90	62.12	1.619	1.619	1.702	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
	51.63	1.334	1.368	1.361	1.361	-.025	-.020	90	60.35	1.527	1.565	1.645	-.025	0	0	0	0	0	0	0	0	0	0	0	0	0				
	49.25	1.218	1.272	1.270	1.270	-.044	-.043	90	56.00	1.343	1.424	1.497	-.060	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
	46.75	1.122	1.180	1.174	1.174	-.052	-.046	90	52.70	1.209	1.311	1.378	-.084	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
	38.83	.759	.875	.870	.870	-.153	-.146	90	43.15	.882	.948	1.019	-.075	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
	135	54.52	1.393	1.393	1.468	0	-.054	135	57.95	1.370	1.370	1.565	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
	46.32	1.031	1.099	1.158	1.158	-.066	-.123	135	48.07	1.043	1.056	1.206	-.012	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
15	45	36.53	.696	.696	.784	0	-.126	15	40.15	.767	.767	.906	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
	90	28.38	.406	.444	.500	-.094	-.232	90	30.18	.485	.487	.551	-.037	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
	51.45	1.281	1.281	1.354	1.354	0	-.057	90	60.12	1.530	1.530	1.638	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
	50.27	1.216	1.239	1.309	1.309	-.019	-.076	90	58.48	1.445	1.479	1.583	-.024	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
	47.87	1.110	1.152	1.217	1.217	-.058	-.096	90	54.40	1.272	1.346	1.440	-.058	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
	45.58	1.021	1.069	1.129	1.129	-.047	-.106	90	51.28	1.146	1.239	1.326	-.081	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
	37.95	.689	.792	.837	.837	-.143	-.215	90	42.13	.836	.916	.980	-.096	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
	135	57.18	1.401	1.401	1.563	0	-.116	135	60.48	1.442	1.442	1.650	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
	49.23	1.071	1.138	1.270	1.270	-.063	-.186	135	50.95	1.136	1.148	1.314	-.011	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
20	45	32.43	.539	.539	.637	0	-.182	20	45	36.00	.614	.614	.753	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	90	24.42	.294	.320	.378	-.089	-.286	90	26.20	.371	.347	.425	-.065	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	49.22	1.147	1.147	1.282	1.282	0	-.118	90	57.50	1.368	1.368	1.549	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
	48.43	1.091	1.109	1.239	1.239	-.016	-.136	90	56.03	1.314	1.323	1.498	-.007	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
	46.18	1.008	1.031	1.152	1.152	-.023	-.143	90	52.30	1.152	1.203	1.364	-.044	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
	44.02	.924	.957	.1069	.1069	-.036	-.157	90	49.37	1.059	1.108	1.255	-.066	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
	36.75	.625	.709	.792	.792	-.134	-.267	90	40.73	.754	.819	.928	-.086	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	135	59.35	1.424	1.424	1.638	0	-.150	135	62.42	1.451	1.451	1.711	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	51.80	1.136	1.189	1.367	1.367	-.047	-.203	135	53.45	1.175	1.192	1.406	-.014	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
25	45	28.27	.406	.406	.496	0	-.222	25	45	31.82	.471	.471	.605	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	90	20.37	.214	.219	.268	-.023	-.292	90	22.10	.272	.241	.308	-.114	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	47.22	1.004	1.004	1.192	1.192	0	-.187	90	54.43	1.198	1.198	1.442	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	46.18	.960	.971	.1152	.1152	-.011	-.200	90	53.12	1.155	1.158	1.394	-.003	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	44.08	.893	.903	.1071	.1071	-.011	-.199	90	49.72	1.026	1.054	1.268	-.026	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	42.08	.834	.838	.994	.994	-.005	-.192	90	47																					

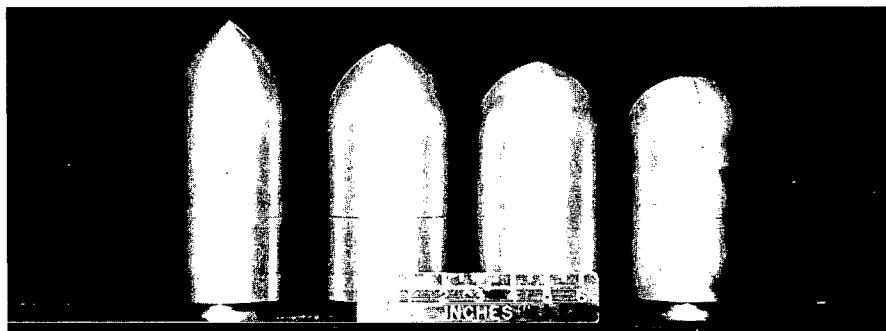
TABLE II.- MEASURED AND THEORETICAL VALUES OF PRESSURE COEFFICIENTS FOR  
THREE-DIMENSIONAL AERODYNAMICALLY BLUNT BODIES - Concluded

(f) Circular-arc bodies;  $\phi = 45^\circ, 90^\circ, 135^\circ$  meridians - Concluded

$\theta_a = 70^\circ$												$\theta_a = 90^\circ$											
$\alpha$ , deg	$\phi$ , deg	$\delta$ , deg	$C_p,meas$	$C_p$	$C_p$	$C_p,meas - C_p$		$C_p,meas - C_p$		$\alpha$ , deg	$\phi$ , deg	$\delta$ , deg	$C_p,meas$	$C_p$	$C_p$	$C_p,meas - C_p$		$C_p,meas - C_p$		$C_p,meas$	$C_p$		
						$C_p,meas$	$C_p$	$C_p,meas$	$C_p$							$C_p,meas$	$C_p$	$C_p,meas$	$C_p$	$C_p,meas$	$C_p$		
0	45	63.73	1.524	1.524	1.528	0	-0.003	0	-0.021	0	45	72.76	1.639	1.639	0	-0.012	0	-0.012	0	-0.012	-0.012	-0.024	
	55.89	1.530	1.500	1.502	.023	.021	.016	.016	.016	90	87.20	1.806	1.806	1.457	.012	0	0	0	0	0	0	0	
	75.28	1.807	1.807	1.778	0	.016	.014	.014	.014	84.32	1.791	1.792	1.792	1.800	-.005	0	0	0	0	0	0	0	
	73.15	1.768	1.770	1.740	-.001	.011	.006	.006	.006	76.54	1.708	1.712	1.712	1.720	-.002	0	0	0	0	0	0	0	
	67.10	1.621	1.639	1.612	-.011	.006	.002	.002	.002	72.83	1.646	1.652	1.652	1.660	-.004	0	0	0	0	0	0	0	
	63.97	1.537	1.560	1.534	-.015	.002	.001	.001	.001	63.40	1.431	1.447	1.447	1.454	-.011	0	0	0	0	0	0	0	
	55.85	1.328	1.323	1.301	.004	.020	.001	.001	.001	135	72.54	1.653	1.653	1.654	0	0	0	0	0	0	0	0	
	63.96	1.535	1.535	1.534	0	.020	.020	.020	.020	63.27	1.417	1.432	1.432	1.450	-.011	0	0	0	0	0	0	0	
	55.88	1.329	1.303	1.302	.020	.020	.020	.020	.020	135	72.54	1.653	1.653	1.654	0	0	0	0	0	0	0	0	
	5	60.00	1.392	1.392	1.425	0	-.024	5	45	68.93	1.544	1.544	1.583	0	0	0	0	0	0	0	0	0	
5	52.22	1.207	1.159	1.187	.040	.017	.002	.002	.002	90	84.21	1.783	1.783	1.800	0	0	0	0	0	0	0	0	
	74.47	1.768	1.768	1.764	0	.002	.001	.001	.001	82.43	1.766	1.770	1.787	1.787	-.002	0	0	0	0	0	0	0	
	72.45	1.729	1.731	1.727	-.001	.001	.001	.001	.001	75.65	1.686	1.690	1.706	1.706	-.002	0	0	0	0	0	0	0	
	66.58	1.590	1.603	1.600	-.008	.006	.006	.006	.006	72.13	1.622	1.631	1.647	1.647	-.006	0	0	0	0	0	0	0	
	63.53	1.506	1.526	1.523	-.013	.011	.006	.006	.006	62.97	1.404	1.429	1.442	1.442	-.017	0	0	0	0	0	0	0	
	55.53	1.300	1.294	1.292	.005	.005	.005	.005	.005	135	75.65	1.685	1.706	1.706	0	0	0	0	0	0	0	0	
	67.25	1.596	1.596	1.616	0	.013	.013	.013	.013	66.55	1.493	1.511	1.530	1.530	-.012	0	0	0	0	0	0	0	
	59.23	1.397	1.386	1.403	.008	.004	.004	.004	.004	135	75.65	1.685	1.706	1.706	0	0	0	0	0	0	0	0	
	10	45	55.97	1.243	1.243	1.305	0	-.050	10	45	64.72	1.429	1.429	1.486	0	0	0	0	0	0	0	0	
	48.28	1.067	1.008	1.059	.055	.007	.002	.002	.002	90	55.77	1.178	1.195	1.243	0	0	0	0	0	0	0	0	
10	90	72.27	1.691	1.691	1.724	0	-.020	90	79.65	1.733	1.733	1.759	0	0	0	0	0	0	0	0	0	0	
	70.48	1.655	1.656	1.688	-.001	.020	.020	.020	.020	78.52	1.719	1.719	1.746	1.746	0	0	0	0	0	0	0	0	
	65.12	1.527	1.524	1.564	-.005	.024	.024	.024	.024	73.28	1.643	1.642	1.668	1.668	.001	0	0	0	0	0	0	0	
	62.23	1.447	1.460	1.488	-.009	.028	.028	.028	.028	70.20	1.579	1.585	1.610	1.610	-.004	0	0	0	0	0	0	0	
	54.58	1.249	1.238	1.262	.009	.010	.010	.010	.010	61.72	1.369	1.388	1.410	1.410	-.014	0	0	0	0	0	0	0	
	69.83	1.656	1.656	1.674	0	.023	.023	.023	.023	135	77.50	1.718	1.718	1.733	0	0	0	0	0	0	0	0	
	62.15	1.460	1.451	1.485	.006	.017	.017	.017	.017	69.20	1.566	1.575	1.589	1.589	-.006	0	0	0	0	0	0	0	
	15	45	51.73	1.106	1.106	1.171	0	-.059	15	45	60.27	1.305	1.305	1.371	0	0	0	0	0	0	0	0	
	44.20	.929	.872	.924	.061	.005	.004	.004	.004	90	74.75	1.648	1.648	1.692	0	0	0	0	0	0	0	0	
15	90	69.10	1.592	1.592	1.658	0	-.041	90	73.98	1.632	1.632	1.680	0	0	0	0	0	0	0	0	0	0	
	67.60	1.563	1.559	1.624	.003	.039	.034	.034	.034	69.95	1.500	1.563	1.604	1.604	-.042	0	0	0	0	0	0	0	
	62.85	1.454	1.444	1.504	.007	.041	.041	.041	.041	67.35	1.500	1.508	1.548	1.548	-.032	0	0	0	0	0	0	0	
	60.22	1.374	1.374	1.431	0	.024	.024	.024	.024	59.73	1.308	1.321	1.356	1.356	-.010	0	0	0	0	0	0	0	
	53.07	1.186	1.166	1.214	.017	.030	.030	.030	.030	135	77.52	1.714	1.714	1.733	0	0	0	0	0	0	0	0	
	71.48	1.658	1.658	1.708	0	.011	.019	.019	.019	70.92	1.600	1.606	1.624	1.624	-.004	0	0	0	0	0	0	0	
	64.47	1.518	1.502	1.547	.011	.036	.036	.036	.036	135	71.45	1.596	1.606	1.634	1.634	-.006	0	0	0	0	0	0	0
	20	45	47.37	.940	.940	1.028	0	-.094	20	45	55.67	1.165	1.165	1.240	0	0	0	0	0	0	0	0	
	39.95	.777	.717	.783	.077	.008	.008	.008	.008	90	47.17	.902	.919	.978	0	0	0	0	0	0	0	0	
20	90	63.35	1.453	1.453	1.570	0	-.081	90	69.82	1.549	1.549	1.601	0	0	0	0	0	0	0	0	0	0	
	64.07	1.429	1.423	1.557	.004	.076	.076	.076	.076	69.25	1.530	1.538	1.590	1.590	-.005	0	0	0	0	0	0	0	
	59.95	1.342	1.318	1.424	.018	.061	.061	.061	.061	66.05	1.466	1.469	1.518	1.518	-.002	0	0	0	0	0	0	0	
	57.60	1.272	1.254	1.355	.014	.065	.065	.065	.065	63.87	1.411	1.418	1.465	1.465	-.005	0	0	0	0	0	0	0	
	51.05	1.098	1.064	1.149	.030	.046	.046	.046	.046	135	57.17	1.219	1.242	1.284	1.284	-.018	0	0	0	0	0	0	0
	71.88	1.643	1.643	1.716	0	.044	.044	.044	.044	71.45	1.678	1.678	1.707	1.707	0	0	0	0	0	0	0	0	
	66.00	1.551	1.518	1.586	.008	.036	.036	.036	.036	71.45	1.596	1.606	1.634	1.634	-.006	0	0	0	0	0	0	0	
	25	45	42.88	.766	.766	.880	0	-.149	25	45	50.98	1.030	1.030	1.098	0	0	0	0	0	0	0	0	
	39.22	.618	.562	.760	.091	.230	.230	.230	.230	90	42.70	.766	.784	.836	0	0	0	0	0	0	0	0	
25	90	61.23	1.284	1.284	1.460	0	-.137	90	64.85	1.434	1.434	1.490	0	0	0	0	0	0	0	0	0	0	
	60.17	1.265	1.257	1.430	.006	.130	.130	.130	.130	64.40	1.421	1.424	1.479	1.479	-.002	0	0	0	0	0	0	0	
	56.60	1.211	1.164	1.324	.039	.093	.093	.093	.093	61.82	1.361	1.360	1.412	1.412	.001	0	0	0	0	0	0	0	
	54.53	1.147	1.108	1.260	.034	.099	.099	.099	.099	59.98	1.305	1.312	1.363	1.363	-.005	0	0	0	0	0	0	0	
	48.60	.992	.940	1.069	.052	.078	.078	.078	.078	54.13	1.131	1.149	1.194	1.194	-.016	0	0	0	0	0	0	0	
	71.00	1.588	1.588	1.699	0	.070	.070	.070	.070	135	72.60	1.625	1.625	1.655	1.655	0	0	0	0	0	0	0	
	66.63	1.513	1.497	1.601	.011	.058	.058	.058	.058	70.70	1.584	1.589	1.620										



(a) Parabolic-arc models.



(b) Circular-arc models.



(c) Conical models.

L-61-1216

Figure 1.- Photograph of three-dimensional aerodynamically blunt bodies.

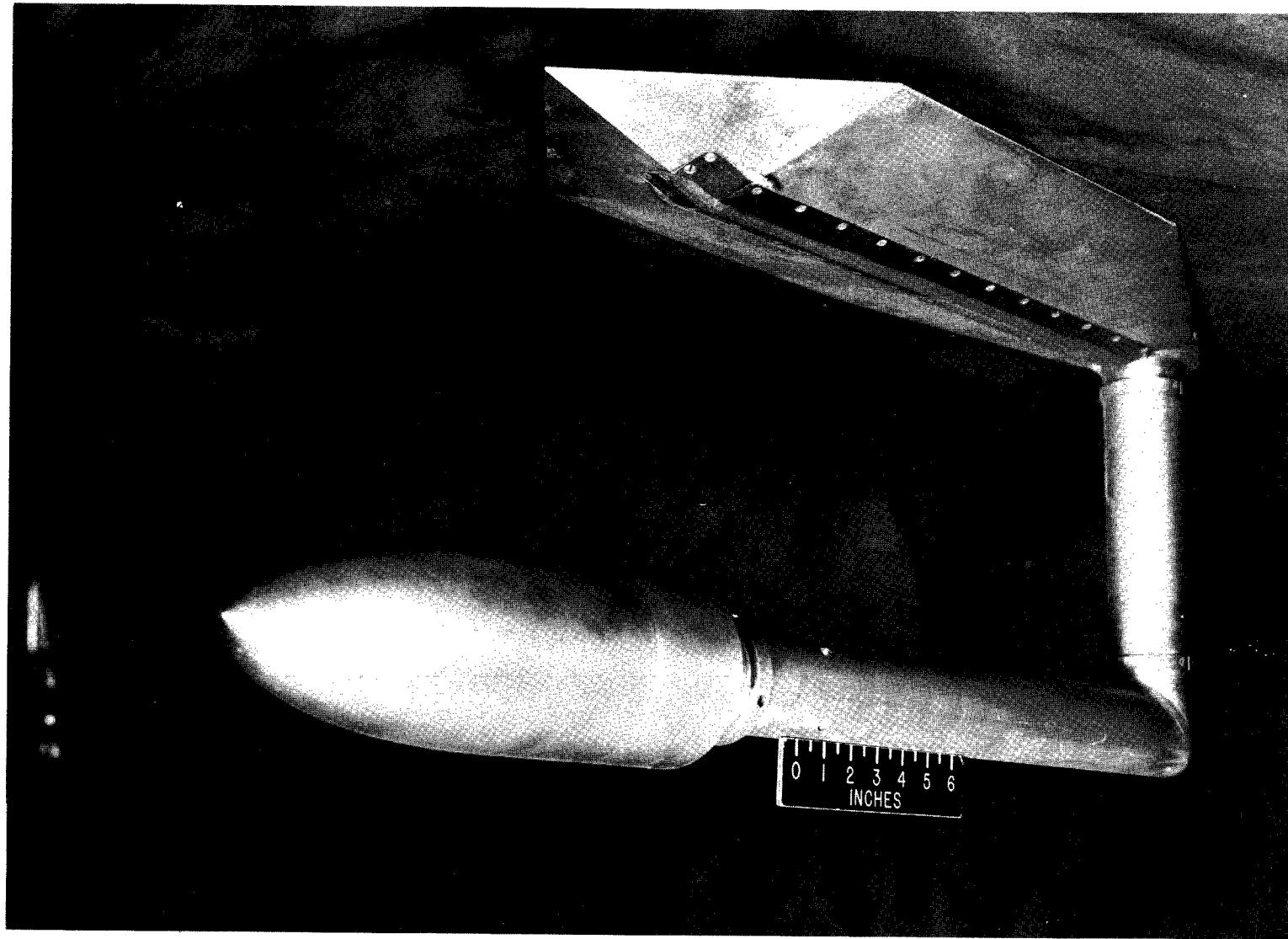


Figure 2.- Photograph of three-dimensional aerodynamically blunt model on a gooseneck support. L-61-1203

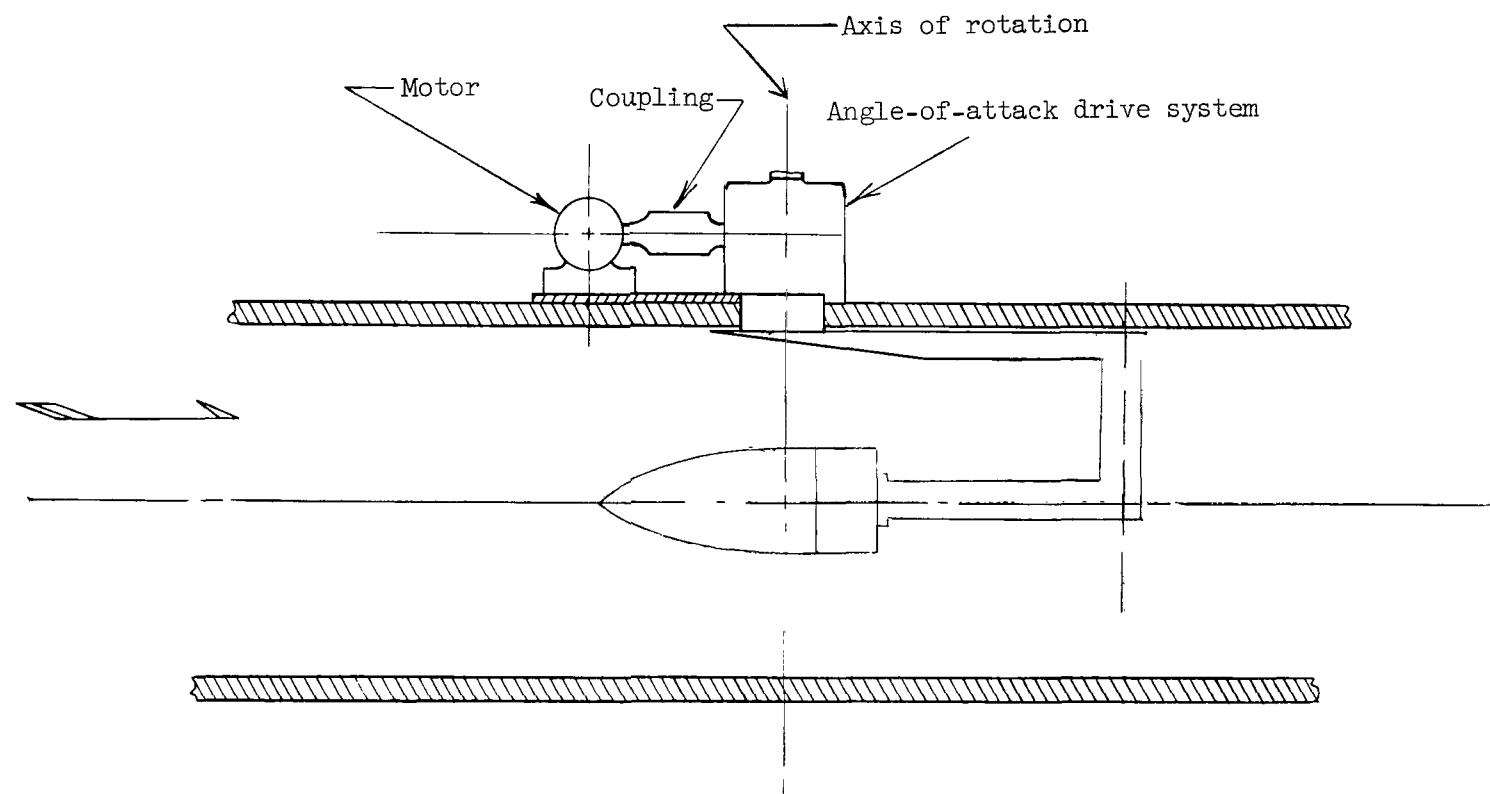


Figure 3.- Schematic diagram of model support system.

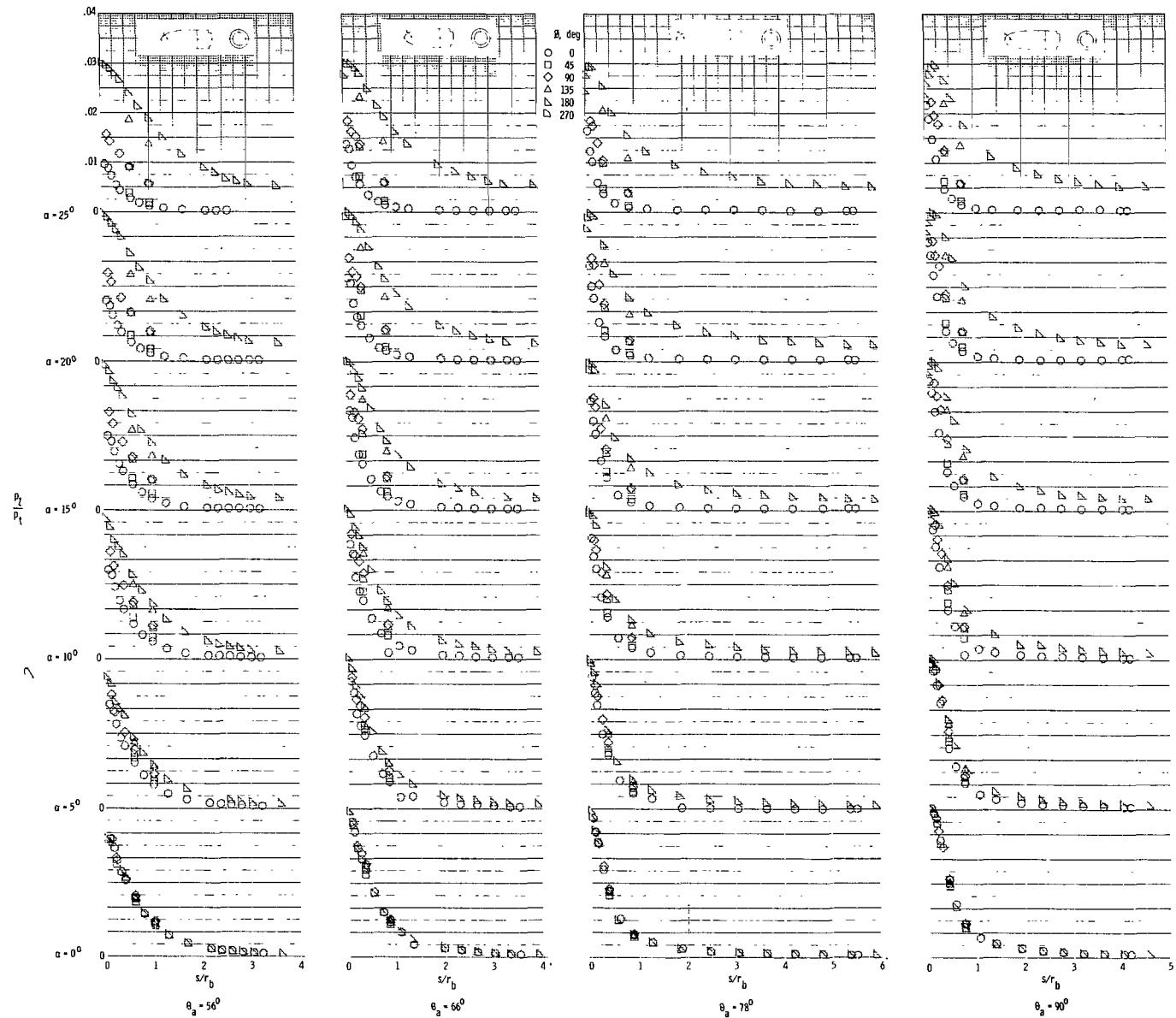


Figure 4.- Pressure distributions of three-dimensional parabolic-arc bodies.

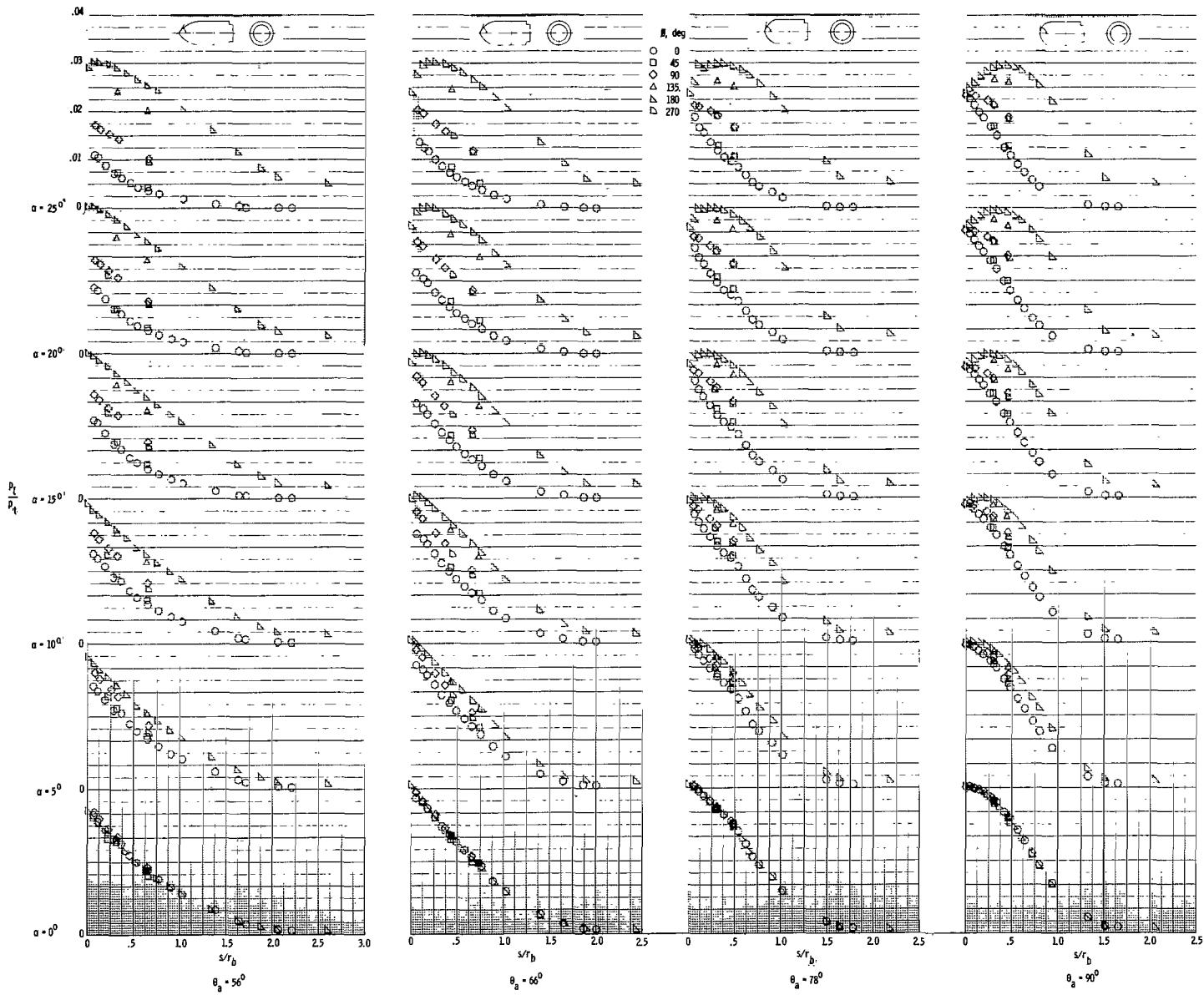


Figure 5.- Pressure distributions of three-dimensional circular-arc bodies.

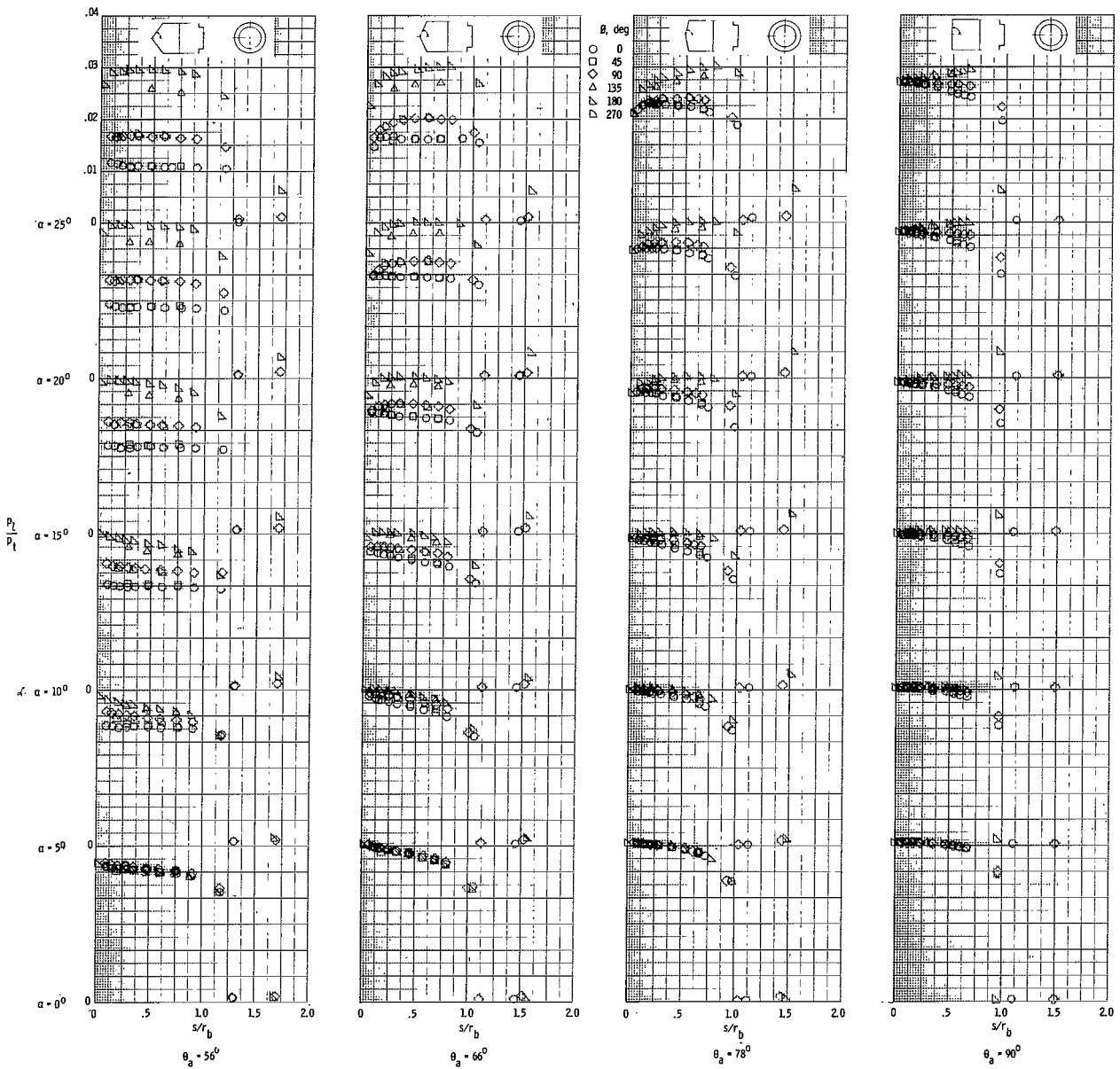
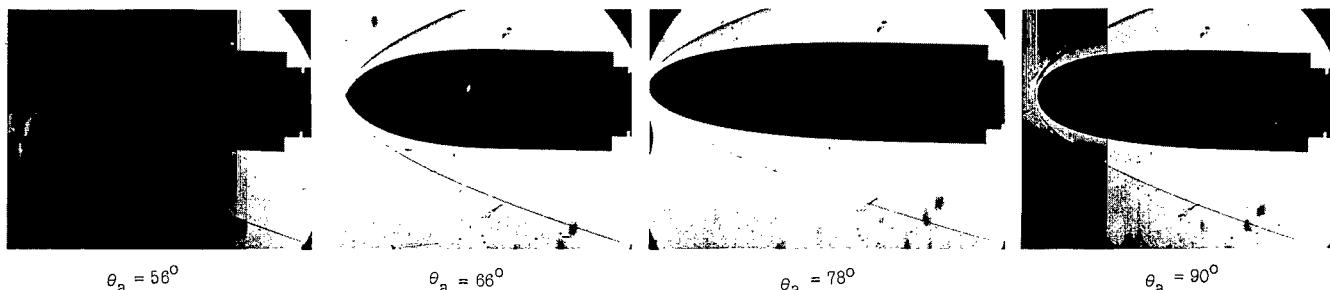
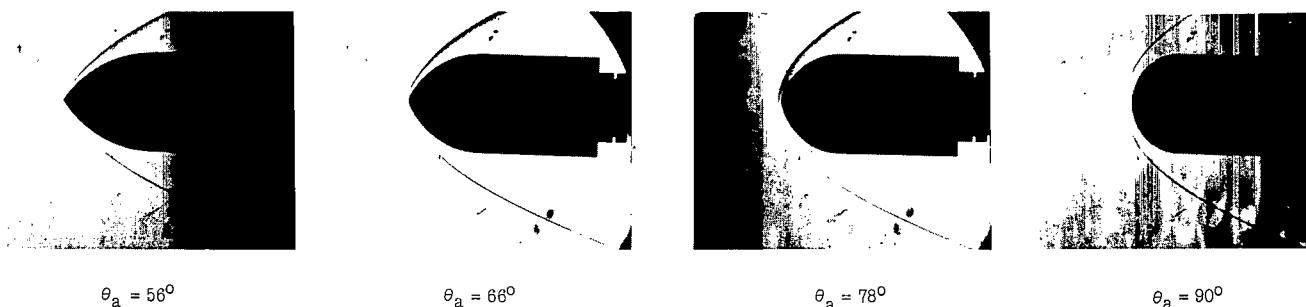


Figure 6.-- Pressure distributions of conical bodies.



(a) Parabolic-arc models.



(b) Circular-arc models.



(c) Conical models.

L-64-4800

Figure 7.- Schlieren photographs of three-dimensional aerodynamically blunt bodies at  $0^\circ$  angle of attack.

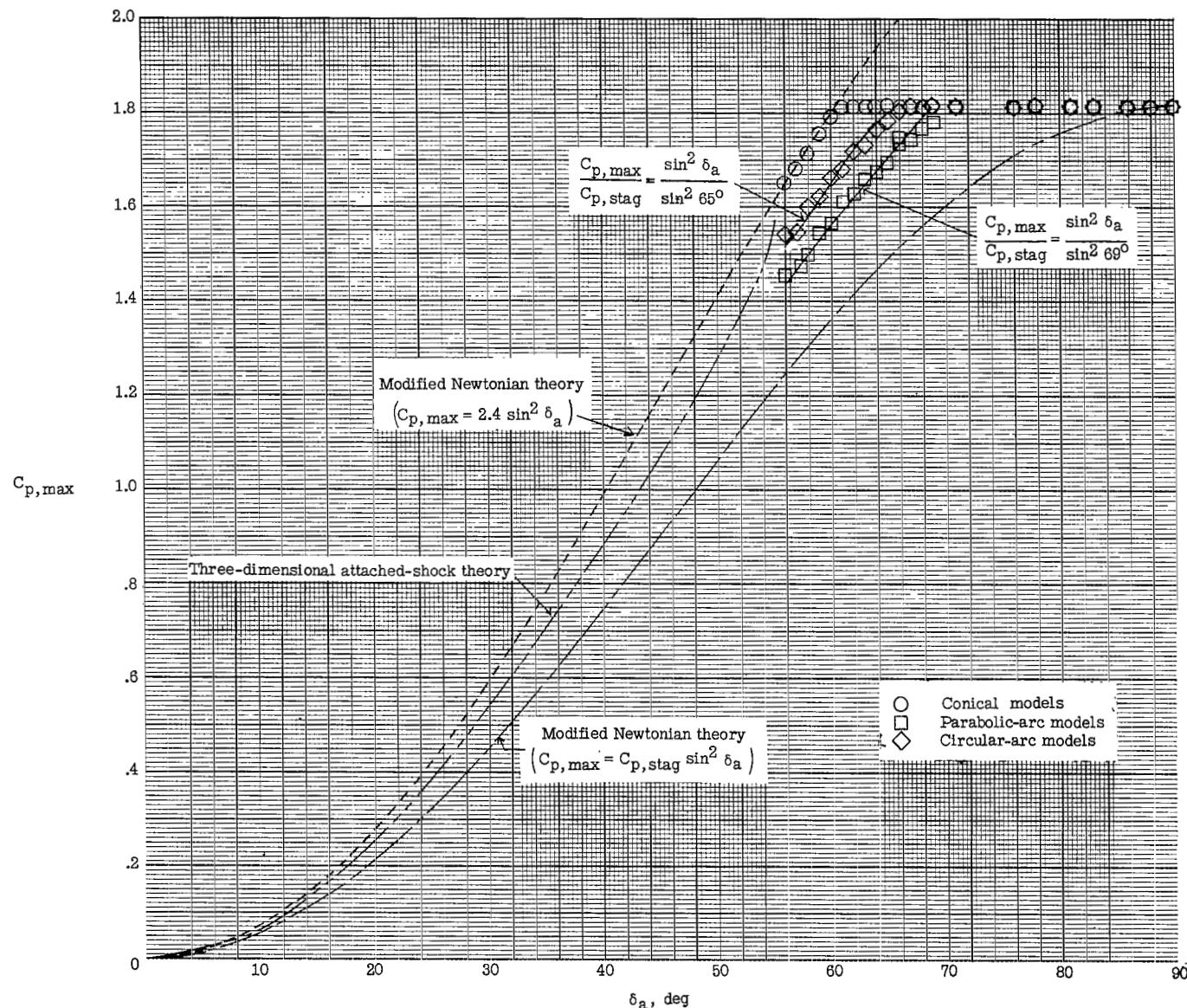


Figure 8.- Comparison of measured and predicted pressure coefficients on  $180^\circ$  meridian for aerodynamically blunt bodies.

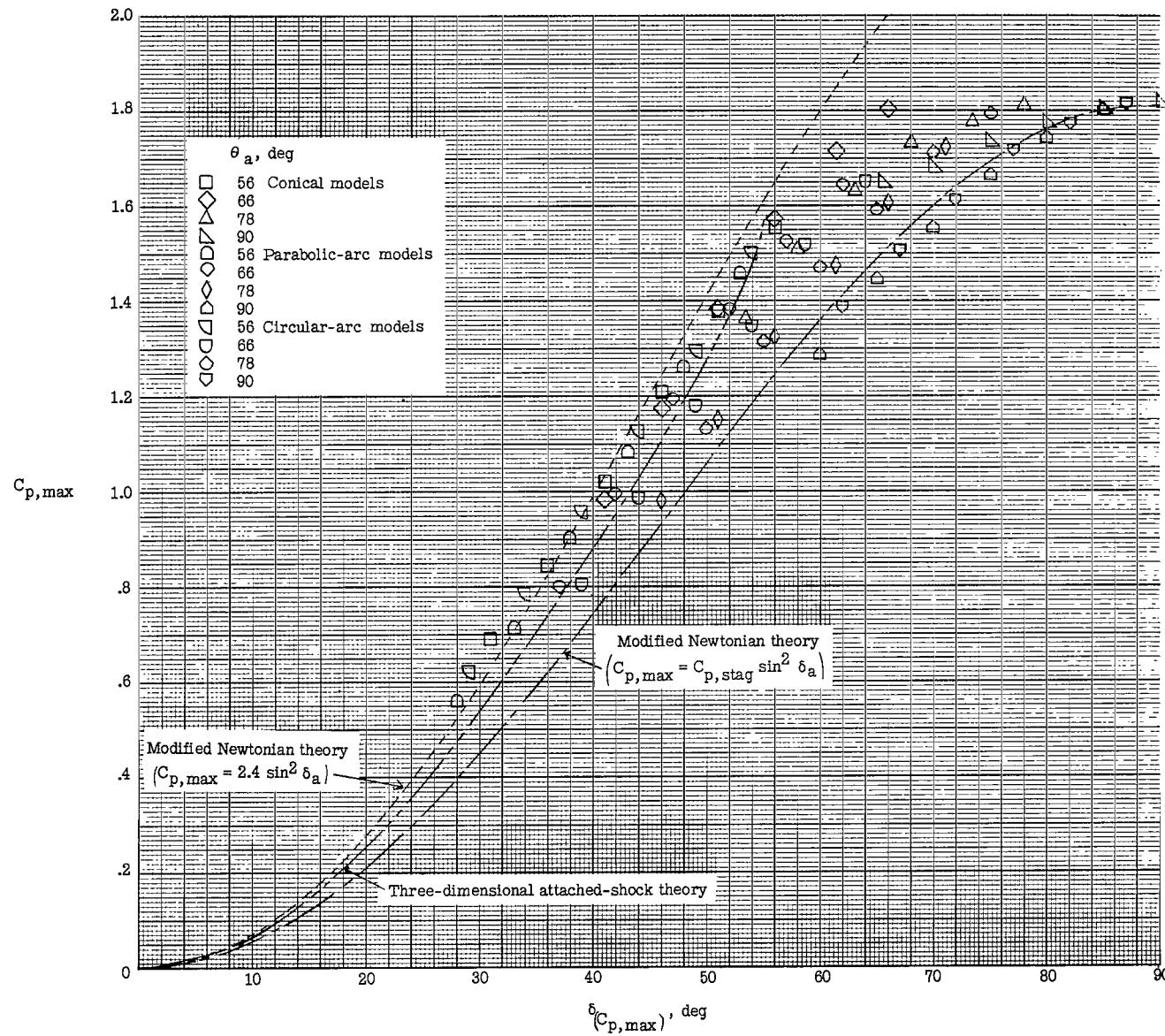


Figure 9.- Comparison of measured and predicted maximum pressure coefficients on 0° meridian for aerodynamically blunt bodies.

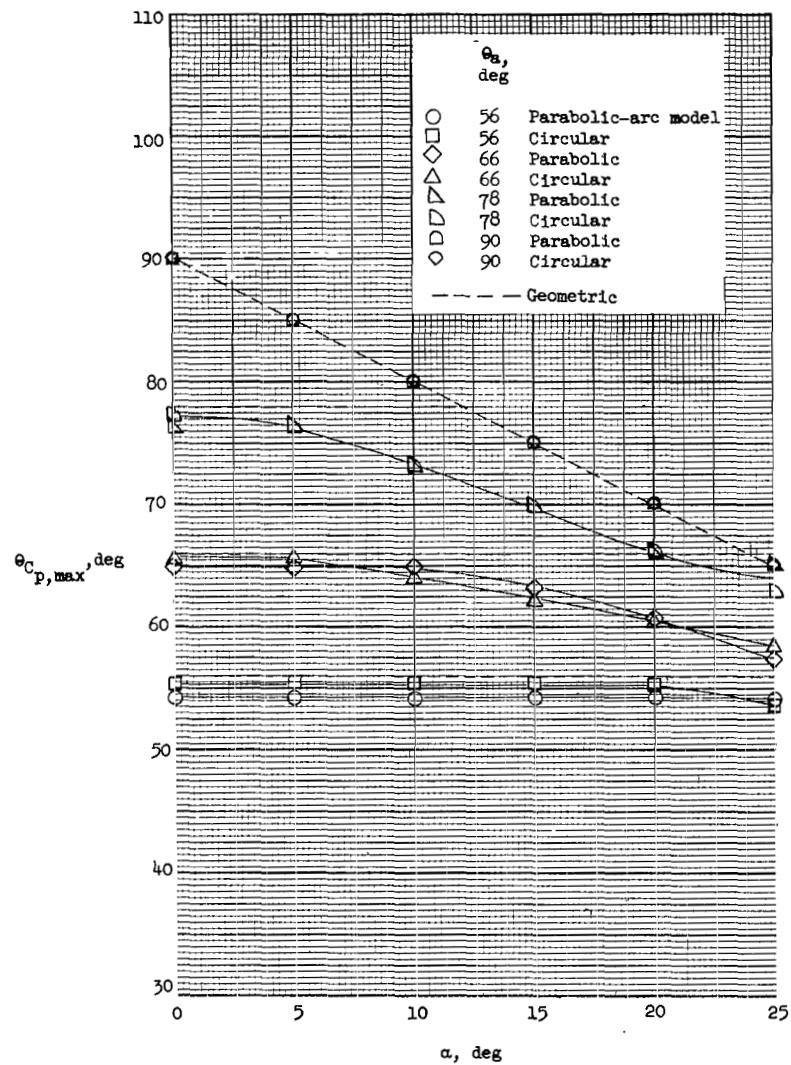
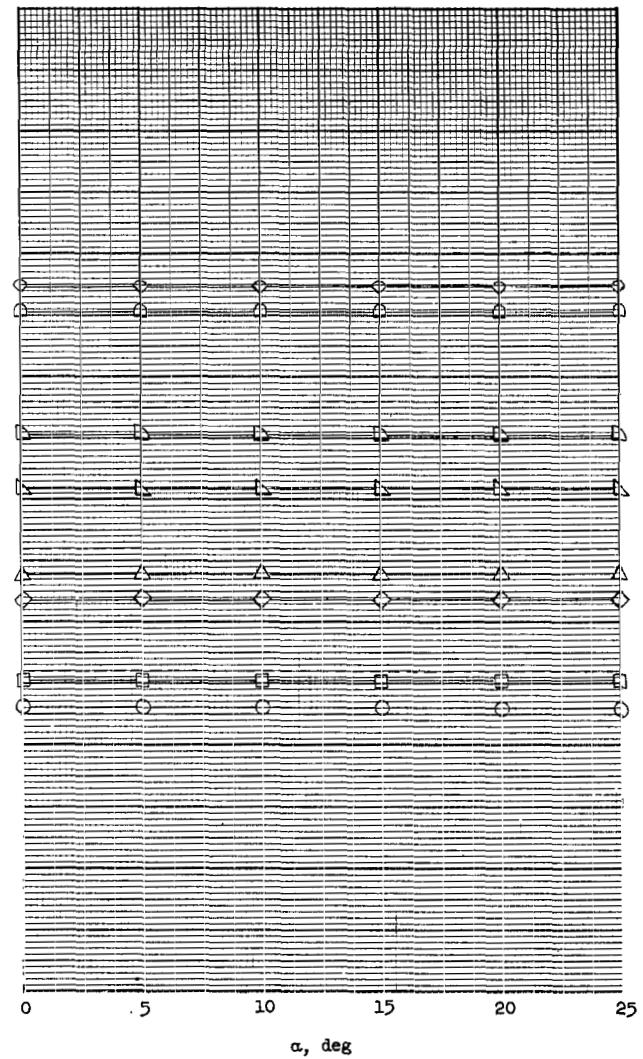
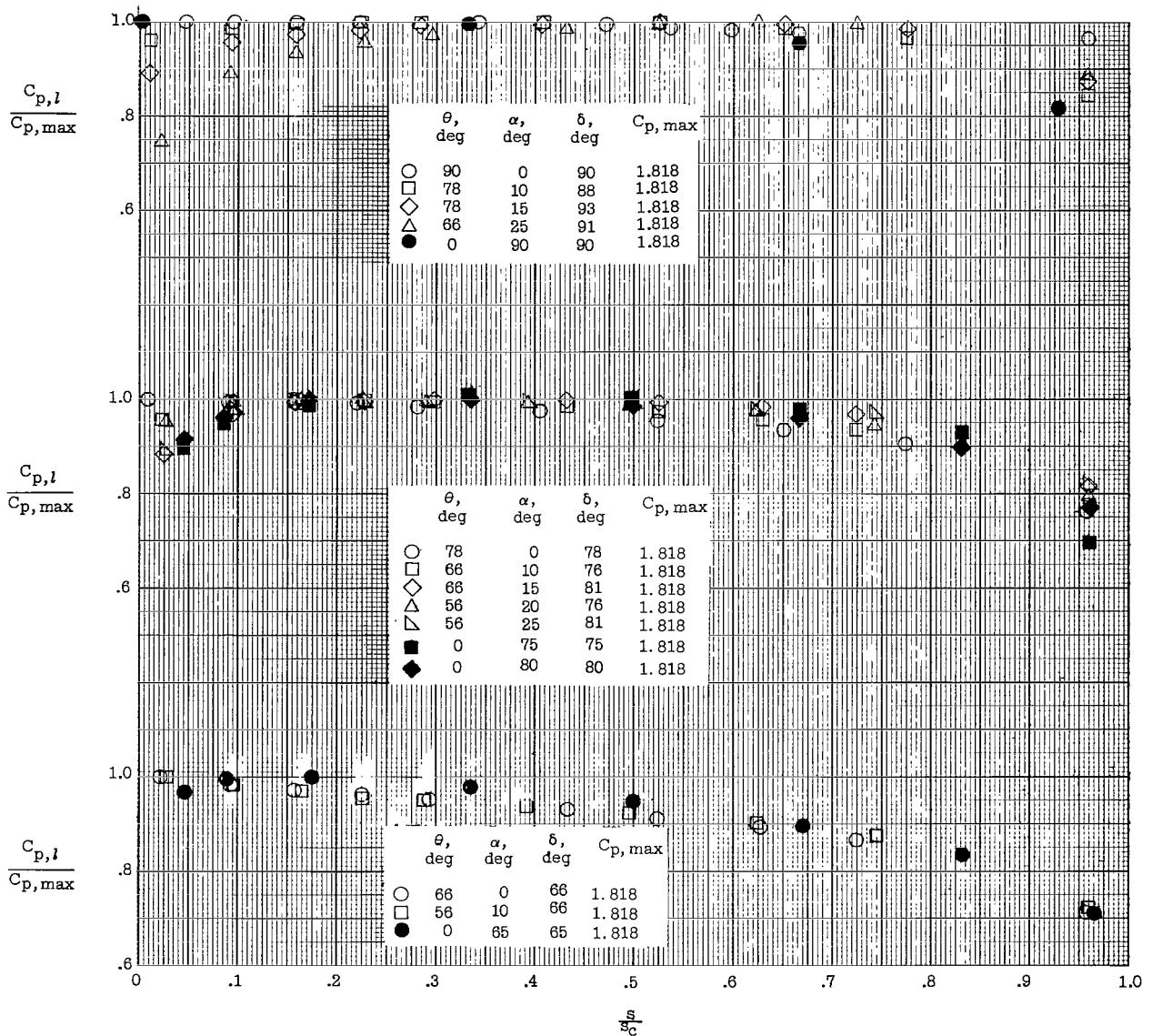
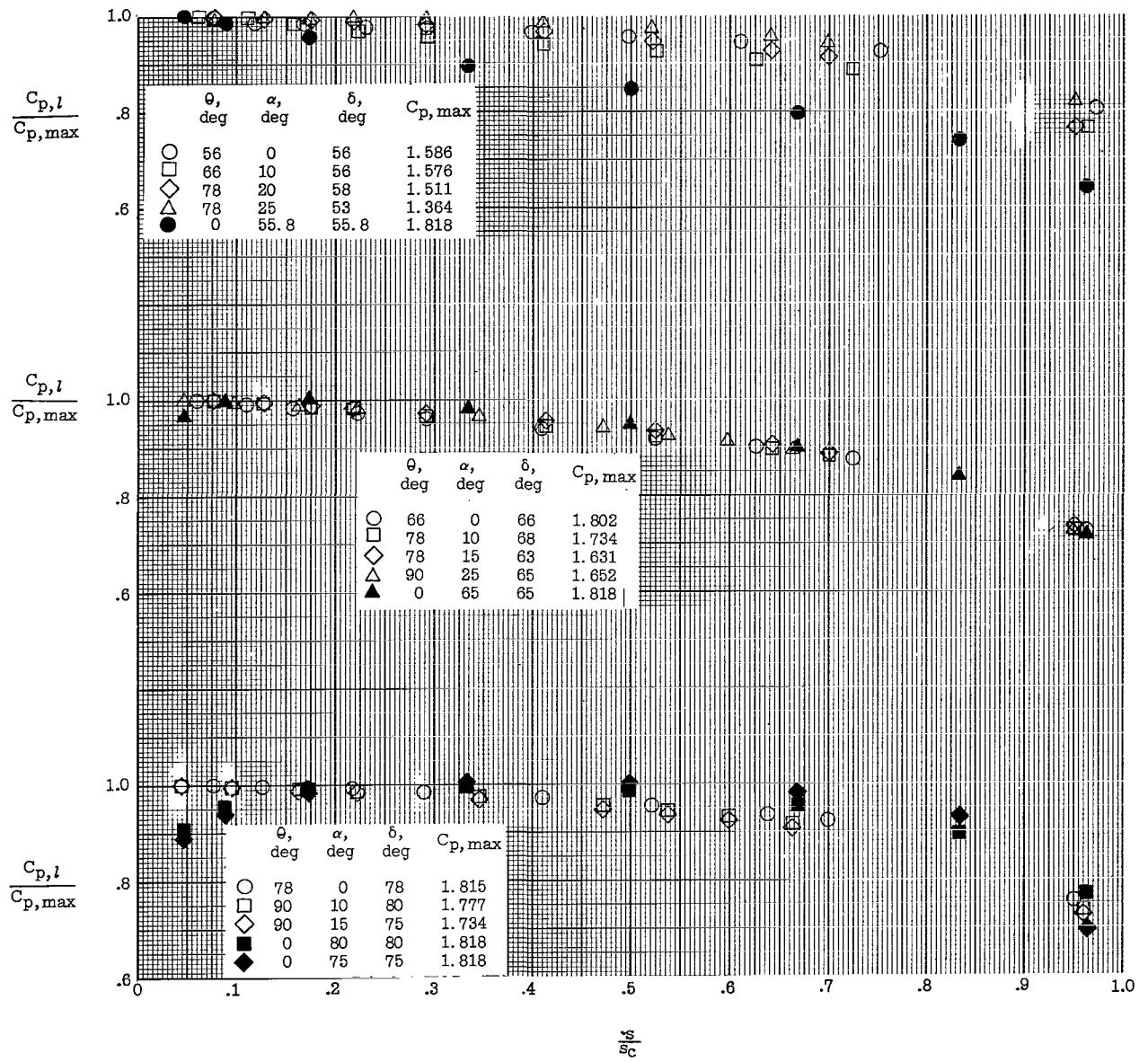
(a)  $\phi = 180^\circ$ .(b)  $\phi = 0^\circ$ .

Figure 10.- Comparison of geometric and actual slopes at which maximum pressure occurred for various angles of attack on parabolic-arc and circular-arc bodies.



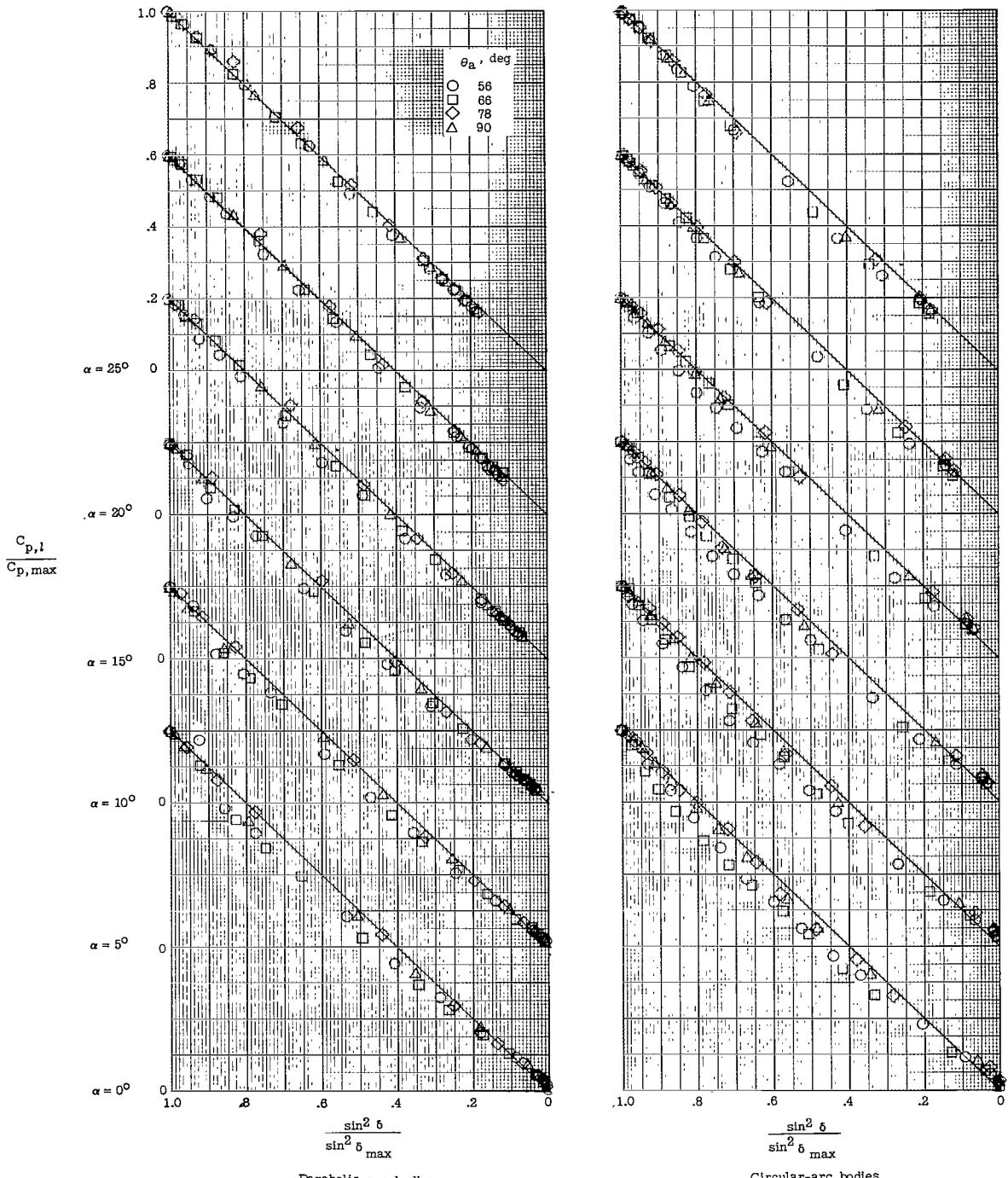
(a)  $\phi = 180^\circ$ .

Figure 11.- Comparison of pressure distributions of cones at constant deflection angles.  
Solid symbols are flat-plate data from reference 8.



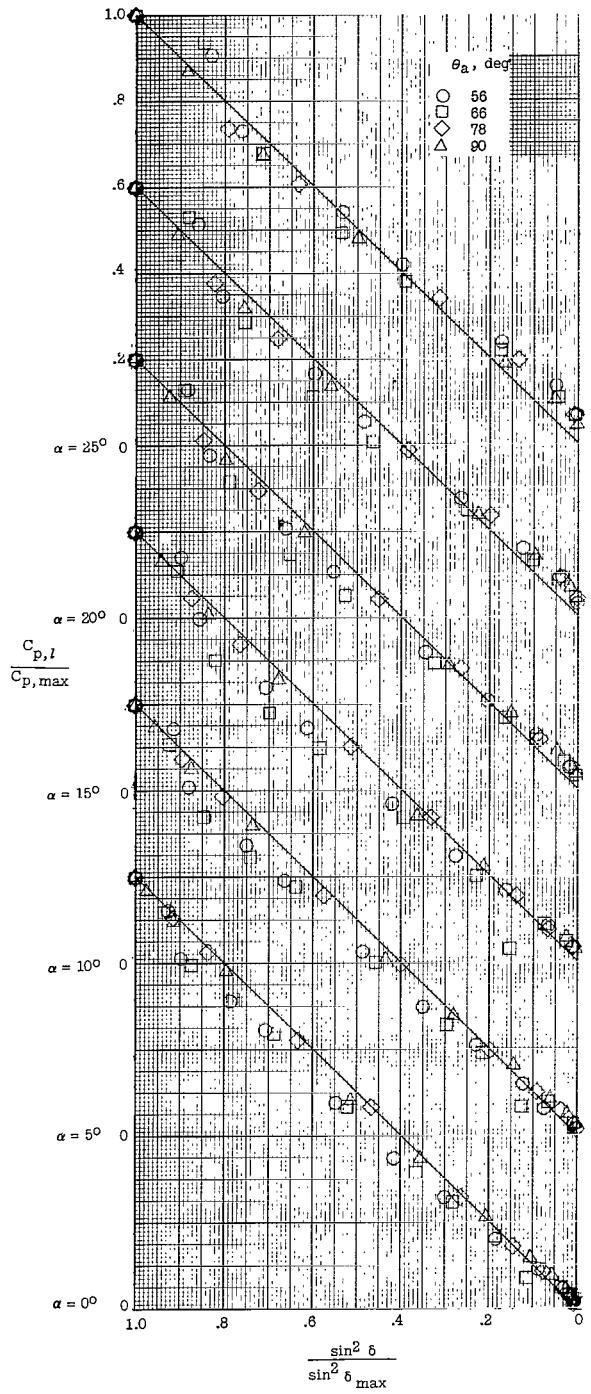
(b)  $\phi = 0^\circ$ .

Figure 11.- Concluded.

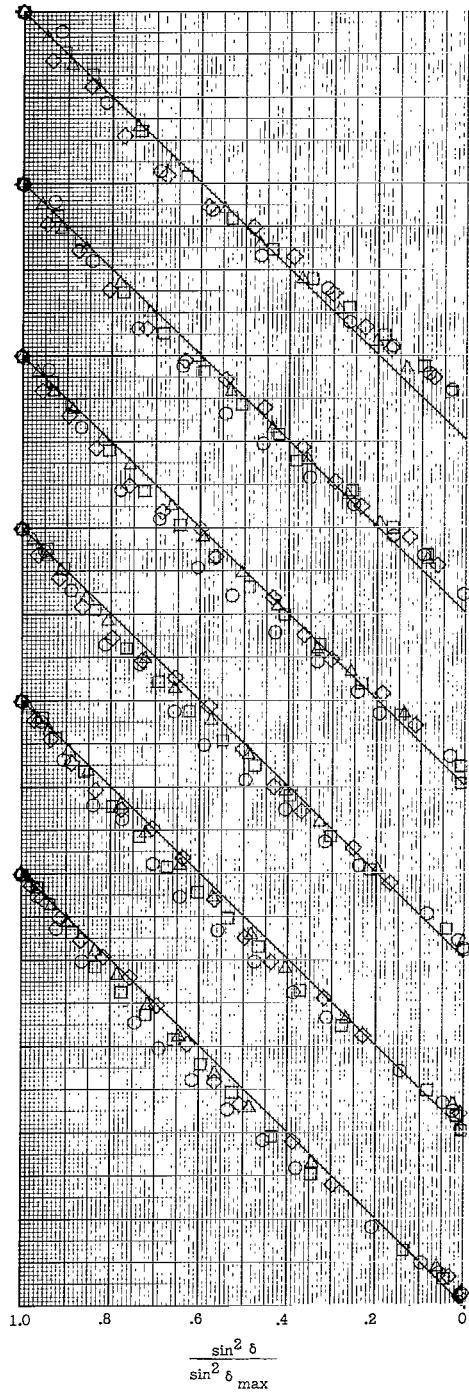


(a)  $\phi = 180^\circ$ .

Figure 12.- Correlation of pressure distributions with generalized Newtonian theory for three-dimensional bodies having curved surfaces.



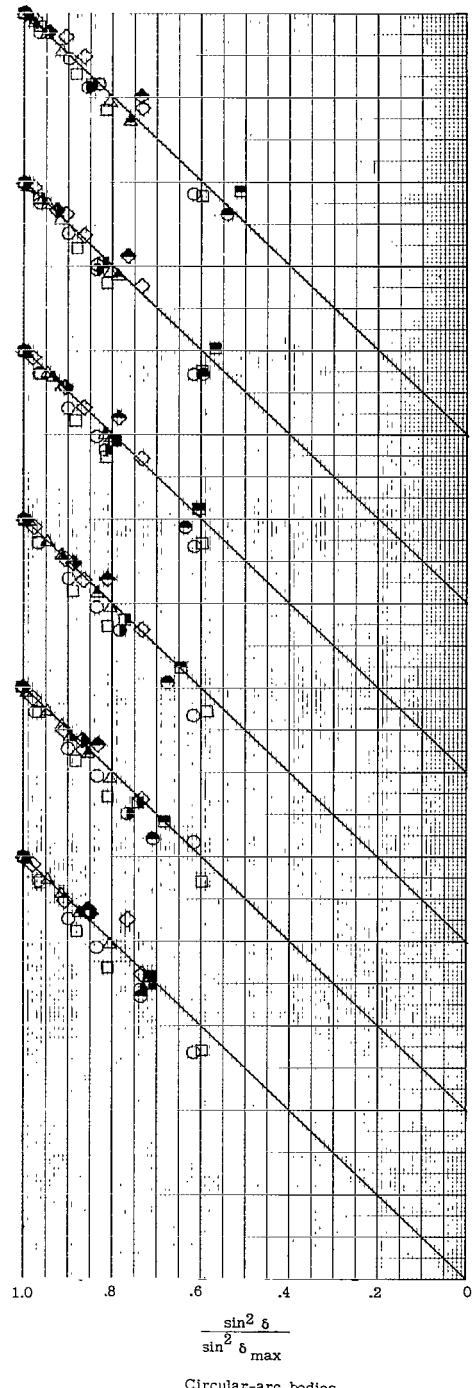
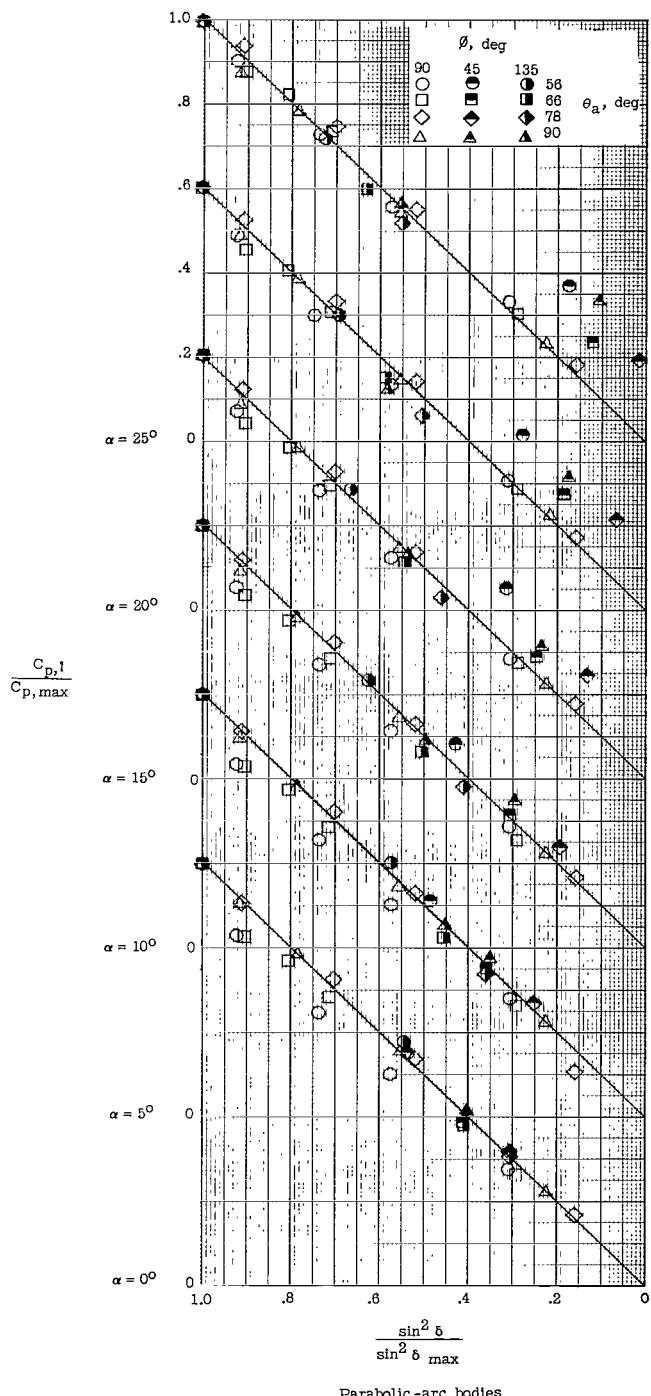
Parabolic-arc bodies



Circular-arc bodies

(b)  $\phi = 0^\circ$ .

Figure 12.- Continued.



(c)  $\phi = 45^\circ, 90^\circ$ , and  $135^\circ$ .

Figure 12.- Concluded.

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—NATIONAL AERONAUTICS AND SPACE ACT OF 1958

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